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NATIONAL DAM SAFETY PROGRAM. DAM NUMBER 2. INVENTORY NUMBER NY --ETC(U)
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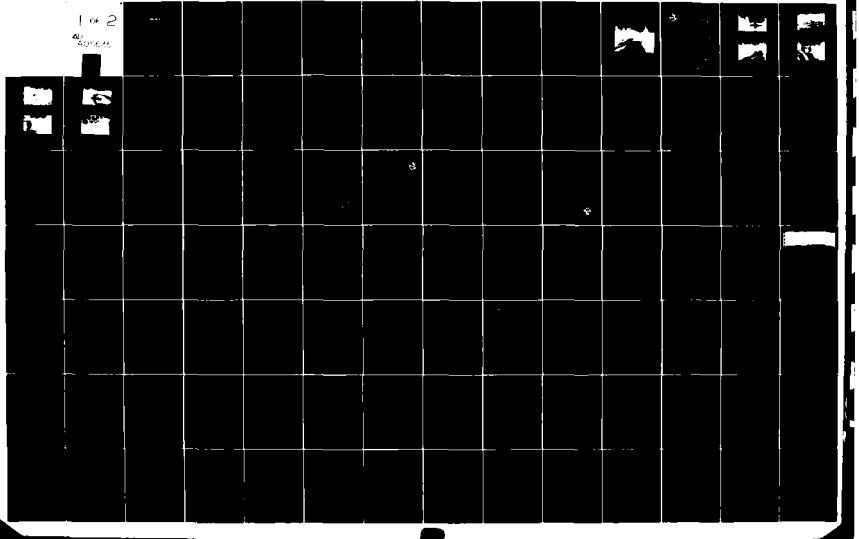

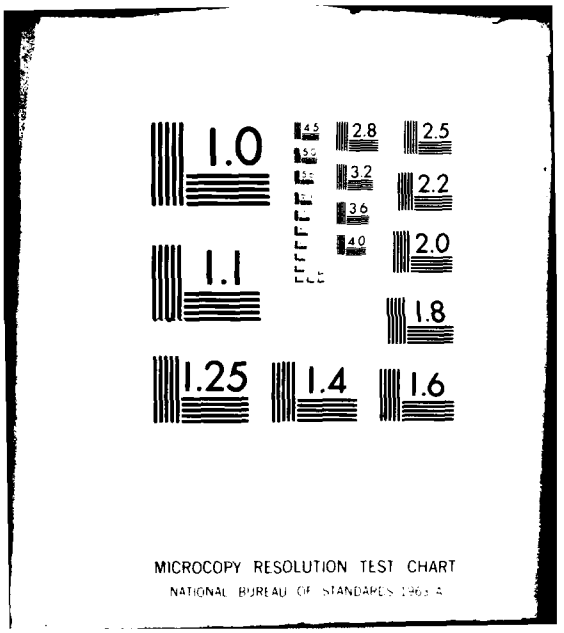
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National Dam Safety Program. Dam Number 21

JEFFERSON COUNTY, NEW YORK

~~INVENTORY NO NY 780~~

PHASE I INSPECTION REPORT. NATIONAL DAM SAFETY PROGRAM

(John B. Sutton)

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NEW YORK DISTRICT CORPS OF ENGINEERS

JULY 1979

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Antwerp

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Dam No. 2, located near Antwerp, New York, is a concrete and stone work gravity dam and is classified as a high hazard. The dam impounds a small linear reservoir which is used to regulate flow into the Village of Antwerp water supply system. Visual inspections of the dam did not reveal conditions which constitute an immediate hazard to human life or property. No plans were available,

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however, surveys of the dam were made for this inspection. Additional studies should be undertaken to further evaluate conditions affecting the dam. Seepage has been located under the stone masonry wall of the south end of the dam at the junction of the wall and the bedrock. Stability computations performed on the dam indicate it is unstable under the loading condition of ice, seismic, and hydrostatic uplift forces, with an associated factor of safety against overturning of 0.92.

Computations prepared using the Corps of Engineer's Screening Criteria have determined that the embankment would be overtopped for all storms exceeding approximately 1% of the PMF (Probable Maximum Flood). A dam break analysis, assuming a partial breaching of the south dam wall, indicates that water surface levels downstream of the dam would not rise appreciably more than if the dam does not break under high flows. The spillway is, therefore, adjudged as not seriously inadequate.

The following remedial actions are recommended:

1. Further investigation regarding the structural stability of the dam should be undertaken. This investigation should include the evaluation of hydrostatic uplift which may exist at the foundation interface and investigation of any tiedown elements which may be presently incorporated in the dam.

2. Repairs should be made to eliminate seepage and improve structural stability at the south abutment of the masonry dam section.

It is, therefore, recommended that within 6 months of the date of notification of the Owners, the above-mentioned investigations or improvements of the structure should be undertaken to determine the appropriate mitigating measures to be taken. Within 18 months of the date of notification, appropriate remedial measures should be completed.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam Dam No. 2, New Antwerp, NY780

State Located New York
County Located Jefferson
Stream Indian River
Date of Inspection May 2, 1979

ASSESSMENT OF GENERAL CONDITIONS

Dam No. 2, located near Antwerp, New York, is a concrete and stone work gravity dam and is classified as a high hazard. The dam impounds a small linear reservoir which is used to regulate flow into the Village of Antwerp water supply system. Visual inspections of the dam did not reveal conditions which constitute an immediate hazard to human life or property. No plans were available, however, surveys of the dam were made for this inspection. Additional studies should be undertaken to further evaluate conditions affecting the dam. Seepage has been located under the stone masonry wall of the south end of the dam at the junction of the wall and the bedrock. Stability computations performed on the dam indicate it is unstable under the loading condition of ice, seismic, and hydrostatic uplift forces, with an associated factor of safety against overturning of 0.92.

Computations prepared using the Corps of Engineer's Screening Criteria have determined that the embankment would be overtopped for all storms exceeding approximately 1% of the PMF (Probable Maximum Flood). A dam break analysis, assuming a partial breaching of the south dam wall, indicates that water surface levels downstream of the dam would not rise appreciably more than if the dam does not break under high flows. The spillway is, therefore, adjudged as not seriously inadequate.

The following remedial actions are recommended:

1. Further investigation regarding the structural stability of the dam should be undertaken. This investigation should include the evaluation of hydrostatic uplift which may exist at the foundation interface and investigation of any tiedown elements which may be presently incorporated in the dam.

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It is, therefore, recommended that within 6 months of the date of notification of the Owners, the above-mentioned investigations or improvements of the structure should be undertaken to determine the appropriate mitigating measures to be taken. Within 18 months of the date of notification, appropriate remedial measures should be completed.

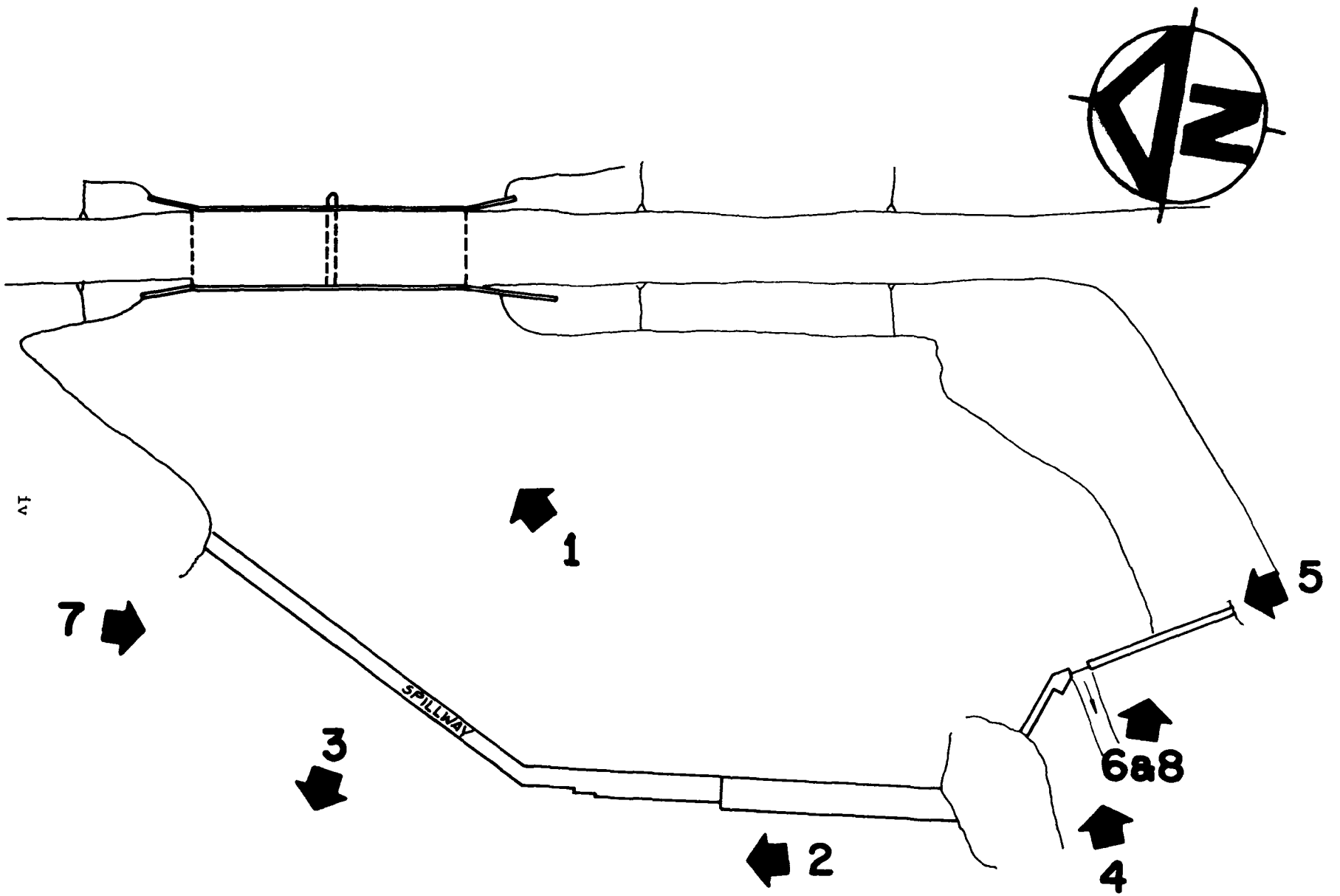
Dale Engineering Company

John B. Stetson, President

Approved By:
Date: 14 Feb 80

Col. Clark H. Benn
New York District Engineer

Overview of dam spillway looking north. Spillway caps bedrock providing reservoir area above rapids.



PHOTOGRAPH KEY PLAN

1. View of reservoir area immediately above spillway area. The reservoir is long and narrow. The bridge crosses the reservoir with a substantial portion of the reservoir upstream of the bridge.

2. Bedrock outcropping and rapids at the dam.

3. Downstream area below spillway.

4. Service spillway passage near south abutment of dam with stop planks removed.

5. View across dam looking north.

6. Area between service spillway and south abutment showing seepage between bedrock and masonry wall section.

7. View across spillway from north abutment lcoking south.

8. Close-up view of seepage area next to service spillway passage.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM - DAM NUMBER TWO ID# - 780

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

Authority for this report is provided by the National Dam Inspection Act, Public Law 92-367 of 1972. It has been prepared in accordance with a contract for professional services between Stetson-Dale and Department of the Army, New York District, Corps of Engineers.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of Dam Number Two and appurtenant structures, owned by the Village of Antwerp, New York, and to determine if the dam constitutes a hazard to human life or property and to transmit findings to the New York District, Corps of Engineers.

This Phase I inspection report does not relieve an Owner or Operator of a dam of the legal duties, obligations or liabilities associated with the ownership or operation of the dam. In addition, due to the limited scope of services for these Phase I investigations, the investigators had to rely upon the data furnished to them. Therefore, this investigation is limited to visual inspection, review of data prepared by others, and simplified hydrologic, hydraulic and structural stability evaluations where appropriate. The investigators do not assume responsibility for defects or deficiencies in the dam or in the data provided.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Dam Number Two is a concrete and masonry gravity structure composed of two sections. One section is approximately 192 feet long, the second section approximately 60 feet long. The dam is approximately 12.3 feet high at its highest point. The dam is founded on bedrock and spans the Indian River immediately downsteam from a road used by the Fort Drum Military Reservation. The service spillway consists of a broad crested weir which composes approximately 145 feet of the longer section of the dam. The shorter section of the dam near the south abutment also contains a 4.7 foot long stop plank structure which is used to regulate pond levels. The dam is founded entirely on bedrock. Bedrock outcrops between the two sections form part of the impounding structure. The receiving channel immediately downstream from the dam is composed entirely of bedrock. There are no

signs of recent erosion. There is some debris lodged in the downstream channel. The impoundment from another dam located in the Village of Antwerp extends to a point approximately 400 feet downstream from Dam Number Two.

b. Location

Dam Number Two is located in the Town of Antwerp, Jefferson County, New York. The dam is also located within the boundaries of the Fort Drum Military Reservation.

c. Size Classification

The maximum height of the dam is approximately 12.3 feet. The storage volume of the dam is approximately 36 acre feet. Therefore, the dam is in the Small Size Category as defined by The Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

The Village of Antwerp is located on the Indian River approximately 3/4 mile downstream from Dam Number 2. A Village street spans the Indian River just downstream from another dam located on the Indian River. Therefore, the dam is in the High Hazard Category as defined by The Recommended Guidelines for Safety Inspection of Dams.

e. Ownership

The dam is owned by the Village of Antwerp, New York.

f. Purpose of Dam

The dam presently impounds a reservoir which is used to regulate flow into the Village of Antwerp water supply system.

g. Design and Construction History

A New York State Conservation Commission Dam Report indicates that a dam was constructed in approximately 1885 at a location which approximates the existing dam. This dam was reconstructed in 1912. Data presented by a dam inventory taken by the Fort Drum facility engineer indicates that the dam was constructed in approximately 1925. Investigations at the dam site with the Mayor of the Village of Antwerp indicate that the dam was faced with concrete on the downstream face and capped with concrete in 1967. No other details of construction were available.

h. Normal Operating Procedures

The control outlets near the south abutment are used to regulate the level of the downstream impoundment which serves as an emergency source of water supply for the Village of Antwerp.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area of Dam Number Two (Fort Drum) is 152.10 square miles.

b. Discharge at Dam Site

No discharge records are available for this site.

Computed discharges:

Spillway, top of dam	454 cfs
Ungated Spillway, PMF	62,800 cfs
1/2 PMF	30,100 cfs
Gated drawdown (stop planks)	N.C.

c. Elevation (Feet Above MSL)

Note: There is no U.S.G.S. control in the area. Elevations are given in local datum and approximate U.S.G.S. elevations are given in parenthesis.

Top of dam	123.0	(515)
Maximum pool, PMF	130.3	(522.3)
1/2 PMF	127.4	(519.4)
Spillway crest	121.9	(514)
Stream bed at centerline of dam (rapids occur beyond this point)	110.7	(502.7)

d. Reservoir

Length of normal pool	3000± Ft

e. Storage*

Top of dam	50 Acre Feet
PMF	410 Acre Feet
1/2 PMF	210 Acre Feet
Normal pool	36 Acre Feet

f. Reservoir Area

Spillway pool (very approximate)	8 Acres

*Approximated from U.S.G.S. topographic maps.

g. Dam

Type - Concrete Gravity, Capping Bedrock.
Length - 252 feet.
Height - Varies, Maximum Concrete Section 10 feet founded on graded bedrock.
Freeboard between normal reservoir and top of dam - 1.23 feet.
Top width - Varies.
Side slopes - Varies
Zoning - N/A.
Impervious Core - Unknown.
Grout Curtain - Unknown.

h. Spillway

Type - Broad to sharp crested.
Length - 143 feet.
Crest Elevation - 121.90 (514).
Gates - None.
U/S Channel - Reservoir.
D/S Channel - Rapids/Bedrock.

i. Regulating Outlets

4.7 foot long stop plank outlet near south abutment.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

All the information available to evaluate this dam has been included in this report. The information consists mainly of survey data taken by the dam inspection crew prior to the inspection.

2.2 CONSTRUCTION

No information is available regarding the construction of the project.

2.3 OPERATION

See Section 4.

2.4 EVALUATION

Engineering data cannot cannot be assessed since it is incomplete. No information is available on the materials of construction and the inspection is guided only by visual observations in the field. However, sufficient information has been gathered through the field inspection efforts to provide information adequate for the Phase I investigation.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Dam Number Two on the Indian River was inspected on May 2, 1979. The dam presently functions to maintain water elevations downstream in the Indian River to provide for for adequate emergency water supply to the Village of Antwerp. The Village's main source of water supply are springs which are remote from the river.

b. Dam

The dam and spillway system are shown in the sketches prepared by Stetson-Dale in Figures 2 and 3. The dam was originally constructed in 1855, and subsequent modifications have taken place with the last modification having been completed in 1967. At the time of the inspection the flow in the Indian River was cresting the entire length the spillway and the regulating weir near the south abutment was open with all stop planks removed. Because of the flow in the Indian River at this time, the inspection crew was unable to observe the condition of the front face of the dam. However, field observations indicate that the entire structure is founded on bedrock. There was no evidence of misalignment of the top of the spillway or of the concrete dam section. The southerly section of the dam near the south abutment is constructed of masonry. Leakage was detected through the base of the masonry near the south abutment. This leakage was of a substantial quantity at the time of the inspection.

c. Spillway

The service spillway was operating at a head of approximately 1 foot at the time of the inspection. Flow over the spillway appeared uniform and there was no evidence of deterioration of the spillway crest as observed with a head of water flowing.

d. Appurtenant Structures

There are no structures appurtenant to this dam. No provisions are provided for draining of the dam except for the removal of stop planks in the control outlet.

e. Control Outlet

A small stop plank structure is located near the south abutment of the dam. This structure was operating under a head of approximately 2 feet at the time of the inspection.

f. Reservoir Area

The reservoir area is generally forested and does not contribute significant amounts of sediment into the impoundment. There are no areas where bank instability exists around the impoundment.

g. Downstream Channel

The downstream channel is formed in bedrock and is generally in good condition.

3.2 EVALUATION

Field observations indicate substantial leakage exists at the south abutment of the southerly section of the dam. This leakage appears to occur between the masonry and the bedrock foundation. No displacement or misalignment of the structure was noted during the inspection. The concrete surfaces which were visible appear to be in good condition.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The operation of the stop planks in the control spillway was not observed by the Inspection Team. The Village of Antwerp manipulates stop planks to control the water level in the downstream impoundment.

4.2 MAINTENANCE OF THE DAM

The dam is maintained by the Village of Antwerp.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE BASIN CHARACTERISTICS

Dam Number 2 is located on the Indian River in Jefferson County just upstream from the Village of Antwerp. The basin has a drainage area of 152 square miles. The upland headwaters contain wooded and marshy areas including Lake Bonaparte from which the river system collects from a complex tributary system and flows north through the Village of Antwerp, eventually discharging into the St. Lawrence River. Alpina dam, a small water level control structure for Lake Bonaparte, is upstream of Dam Number 2.

5.2 ANALYSIS CRITERIA

The purpose of this investigation is to evaluate the dam and spillway with respect to their flood control potential and adequacy. The dam's stability and flood discharge capacity is assessed through the evaluation of the Probable Maximum Flood (PMF) for the watershed and the subsequent routing of the flood through the dam's spillway system.

The PMF event is that hypothetical flow induced by the most critical combination of precipitation, minimum infiltration loss and concentration runoff of a specific location that is considered reasonably possible for a particular drainage area. Since this dam is in the Small Dam Category and is a High Hazard, the guidelines criteria (Ref. 1) require that the dam be capable of passing one-half the Probable Maximum Flood.

The hydrologic analysis was performed using the unit hydrograph method to develop the flood hydrograph. Due to the limited scope of this Phase I investigation, certain assumptions, based on experience and existing data were used in this analysis and in the determination of the dam's spillway capacity to pass the PMF.

The U.S. Army Corps of Engineers, Hydrologic Engineering Center's Computer Program HEC-1DB was utilized to evaluate the PMF hydrology. The Probable Maximum Precipitation (PMP) was 18.50 inches, Hydrometeorological Report (HMR #33) for a 24 hour duration, 200 square mile basin. Loss rates adopted for the analysis were 1.0 initial abstraction and 0.1 inches/hour continuous loss rate. Clark parameters were used to develop the unit hydrograph.

The drainage basin was divided into 12 sub-areas to describe the complex basin geometry. One sub-area was located below the dam so that flood routing could be performed to within the Village. Modified-Puls routing parameters within HEC1-DB were utilized with data obtained from USGS mapping. The computed PMF flow at the dam was 62,800 cfs and the 1/2 PMF was 30,095 cfs. Routed flood flows to the village were 62,605 cfs for the PMF and 30,035 cfs for 1/2 PMF.

5.3 SPILLWAY CAPACITY

The spillway system is somewhat unique in that it sets atop of a rapids area with rock outcropping existing below the dam as well as across the dam. Rock outcropping also exists in the center of the spillway. The concrete dam sets on top of the rock with a low flow spillway section of the northern side and a small spillway passage with stop planks on the south side. The low flow spillway capacity is 454 cfs.

SPILLWAY CAPACITY

	Discharge	Capacity
PMF	62,800	1.0%
1/2 PMF	30,095	1.5%

Since the entire dam is made of concrete overtopping is most meaningful at the abutment areas which have been found to be largely on rock.

5.4 RESERVOIR CAPACITY

No drawings were available for this investigation. Topographic information derived from USGS mapping suggests the reservoir storage may be only 50 acre feet at the top of the dam. At 1/2 PMF stage, the reservoir total storage is 210 acre feet. USGS maps can only provide a cursory screening level evaluation.

5.5 FLOOD OF RECORD

No records, basin ungaged.

5.6 OVERTOPPING ANALYSIS

The HEC1-DB analysis indicates that the dam would be overtopped as follows:

OVERTOPPING IN FEET

	At Dam	Bridge at Village
PMF	7.3	13.1
1/2 PMF	4.4	6.2

Overtopping was performed with a dam break analysis which resulted in an insignificant increase in flood flows for the 1/2 PMF and PMF. Stability calculations indicated that the dam was stable for both these events, assuming the uplift forces for these events are the same as assumed for normal operating conditions.

5.7 EVALUATION

The spillway is inadequate to pass the 1/2 Probable Maximum flood without overtopping the dam. However, based on the Corps of Engineers' Screening Criteria, it is not considered seriously inadequate, since failure of the dam will not significantly increase the hazard.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations And Data Review

Rock outcrops prevail at the location of this dam. Virtually all of the main dam spillway, a concrete structure, is founded directly on the exposed bedrock and/or incorporates the rock as part of the structure. A short section of dam which forms the southerly segment of the total dam structure is "separated" from the main section by a rock outcropping. This separate section consists of masonry and concrete, and includes a service spillway of limited size; this separate dam section and spillway apparently represented the flume area for a water-powered mill, ice harvesting or wood operation which existed at the site in the past. The downstream pool area immediately below the dam consists essentially of rock.

The main dam and spillway section retains stability at this time with no indication of structural distress. The physical condition of the concrete visible at the time of the inspection is good. The separate masonry section forming the southerly segment of the total dam appears structurally stable but some of the masonry rock elements have experienced limited movement, probably from frost effects, and noticeable seepage occurs through the section. This section occurs at the junction with bedrock.

b. Geology and Seismic Stability

The Antwerp Dam and reservoir is located within the western edge of the foothills of the Adirondack Province. The New York State Conservation Report of September 14, 1914, indicates the dam is sited on solid rock. Both abutments terminate in bedrock and bedrock also forms a portion of the spillway. Bedrock is a biotite-hornblende granitic gneiss (Precambrian) locally pyroxeneic with subordinate amounts of leucogranitic gneiss. Amphibolites are locally present. Foliation strikes northeast and dips northwest.

Although gneiss has considerable strength and bearing capacity, weathering of the biotite, hornblende and pyroxene components of the rock as well as the amphibolites may yield rotted seams conducive to seepage.

There are no known faults or shear zones in the vicinity of the reservior according to the New York State Geologic Map (1970) and the Preliminary Brittle Structures Map of the New York State Geologic Survey (1977). The Brittle Structures Map does show a linear feature trending east-west which apparently follows the trend of Indian River east of the village of Antwerp. This linear feature appears to be either near or through the dam site. It may represent a fracture or fault, but is not indicated or shown on the New York State Geologic Map. If a fracture or shear zone does exist, it would be out of view beneath the river.

A shear zone trending northeast lies about 9 miles northwest of the dam according to the New York State Geologic Map. An extensive shear zone, about 2 miles wide and also trending northeast, is located about 10 miles southeast of the dam according to the 1977 Preliminary Brittle Structures Map. This map also shows another shear zone about 7 miles east-northeast of the dam and trending northeast.

Although the dam site is located in Zone 3 on the Seismic Probability Map, a Zone 2 designation would be proper. No earthquake activity has been recorded in the immediate vicinity of the dam. Between 1932 and 1963 five minor earthquakes were recorded from the Watertown area approximately 22 miles southwest of the dam site. None were of an intensity greater than III (modified Mercalli scale). An earthquake of intensity III was recorded from Alexandria Bay 18 miles to the northwest and another of intensity of VI had been recorded near Lowville approximately 34 miles to the south.

c. Data Review and Stability Evaluation

Information from the past relating to the as-built construction of the dam is limited to rough sketches of plan alignment and cross-sections from a field inspection report of 1914, a date that is a few years after the reported construction date. A field survey undertaken as part of this Phase I study has provided information on the present dam cross-section (Figures 2 - 4) but did not extend to determining properties of the dam materials and foundation rocks. Stability evaluations have been performed, utilizing the obtained cross-section information to obtain an indication of the dam's performance when subject to different possible loading conditions. In these analyses, some assumptions were required in regard to concrete and rock properties and the geometry of the dam cross-section.

The effects of a reservoir at the main spillway level along with ice affects, and a reservoir at the PMF level, have been studied. The results for these conditions are summarized in the following table. The analyses are included in Appendix D.

RESULTS OF STABILITY COMPUTATIONS

	Loading Condition	Factor of Safety* Overturning	Factor of Safety* Sliding**	Location of Resultant*** Passing through Base
(I)	Reservoir level at spillway elevation,			
(i)	no uplift on base, no ice acting	8±	---	
(ii)	uplift on base, no ice acting	2.8±	37±	0.46b
(iii)	uplift on base, ice one foot thick acting	1.14±	12±	0.09b
(iv)	no uplift on base, ice one foot thick acting	1.56±	---	
(II)	Reservoir level at 1/2 PMF elevation, uplift acting on base as computed for normal operating conditions.	1.8±	17±	0.33b
(III)	Reservoir level at PMF elevation, uplift acting on base as computed for normal operating conditions.	1.75±	13±	0.37b
(IV)	Reservoir level at spillway elevation with earthquake forces acting (utilizing seismic coefficients applicable to Zone 3 Probability Area)			
(i)	uplift, no ice	1.77±	---	0.36b
(ii)	uplift, ice one foot thick acting	0.92±	---	

*These factors of safety indicate the ratio of moments resisting overturning to moments causing, and the ratio of forces resisting sliding to those causing sliding; a ratio less than unity indicates instability. Upstream and downstream pool levels were obtained from HEC-1DB analysis.

**As determined applying the friction-shear method.

***Indicated in terms of the dam's base dimension, b, measured from the toe of the dam.

The analyses indicate unsatisfactory stability against overturning for certain combinations of loading.

Critical to the analysis and resulting indication of stability are the items of uplift water pressures acting on the foundation of the dam and the permeability of the foundation site's bedrock. The analysis uplift force was based on full headwater hydrostatic pressure acting at the dam's foundation upstream corner and a zero tailwater hydrostatic pressure acting at the dam's downstream corner, with the resulting triangular force pattern applied to 100 percent of the dam's section. The resulting uplift force represents a condition that is significant to the analysis in arriving at the computed low factors of safety against overturning.

The assigned uplift force is believed to be conservative but could be too severe if the dam is embedded in sound rock. The prediction of uplift acting on the base of a gravity dam founded on rock without information on the permeability and seepage properties of the rock stratum represents an analytical area of great uncertainty. If the rock is very sound and impermeable, seepage would be very low and uplift pressures of significance would require a long period of time to develop. A conclusion for such a condition is that the computed uplift may not exist at the present time, and only develop at some future time.

The analysis indicates instability could occur if the dam is subject to earthquake forces of magnitude. Though the reservoir area is grouped into a Zone 3 Seismic Probability location, a current geologic-seismic evaluation recommends a Zone 2 designation for the site.

Requirement for attention at this time includes proper repair of the masonry flume dam/spillway structural comprising the "separate" southerly section of the (total) dam to improve the structural integrity and to limit seepage.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

1. At the southerly section of the dam near the south abutment, the wall is constructed of stone masonry. Leakage was detected at the foundation of this masonry section. This leakage was of a substantial quantity at the time of inspection.

2. At the time of inspection, all the stop planks in the regulating weir were removed.

3. The entire structure was observed to be founded on bedrock.

4. There was no evidence of misalignment of the top of the spillway or the dam.

5. The stability analysis shows that the dam is unstable under conditions of uplift, ice and seismic loading, with a factor of safety of 0.92.

6. The abutments of the dam should be inspected to evaluate erosion potential under high floods which would overtop the dam.

7. The dam is founded on bedrock and is located on top of a rapids area. A small low level overflow spillway has a capacity of 454 cfs. Considering this discharge to be the top of dam capacity, the dam can pass 1.0% of the PMF without overtopping. The 1/2 PMF overtops the dam by 4.4 feet and the Village bridge, crossing the Indian River, by 6.2 feet.

b. Adequacy of Information

1. The sections of the dam were obtained from field surveys conducted while the spillway was operating under substantial head. There is no outlet in the dam to allow the dam to be drawn down.

2. The basin is ungaged and no flow records or information on high water levels were available to use to develop and calibrate the HEC-1DB model. High water mark data would have been of benefit in the Hydrologic/Hydraulic Analysis.

3. Topographic information at the dam site and in the Village was limited to USGS mapping data and the limited surveys in this report. More detailed information is necessary to evaluate flood flow characteristics at the dam site and in the Village.

c. Urgency

Further investigations regarding the dam's structural stability should be undertaken.

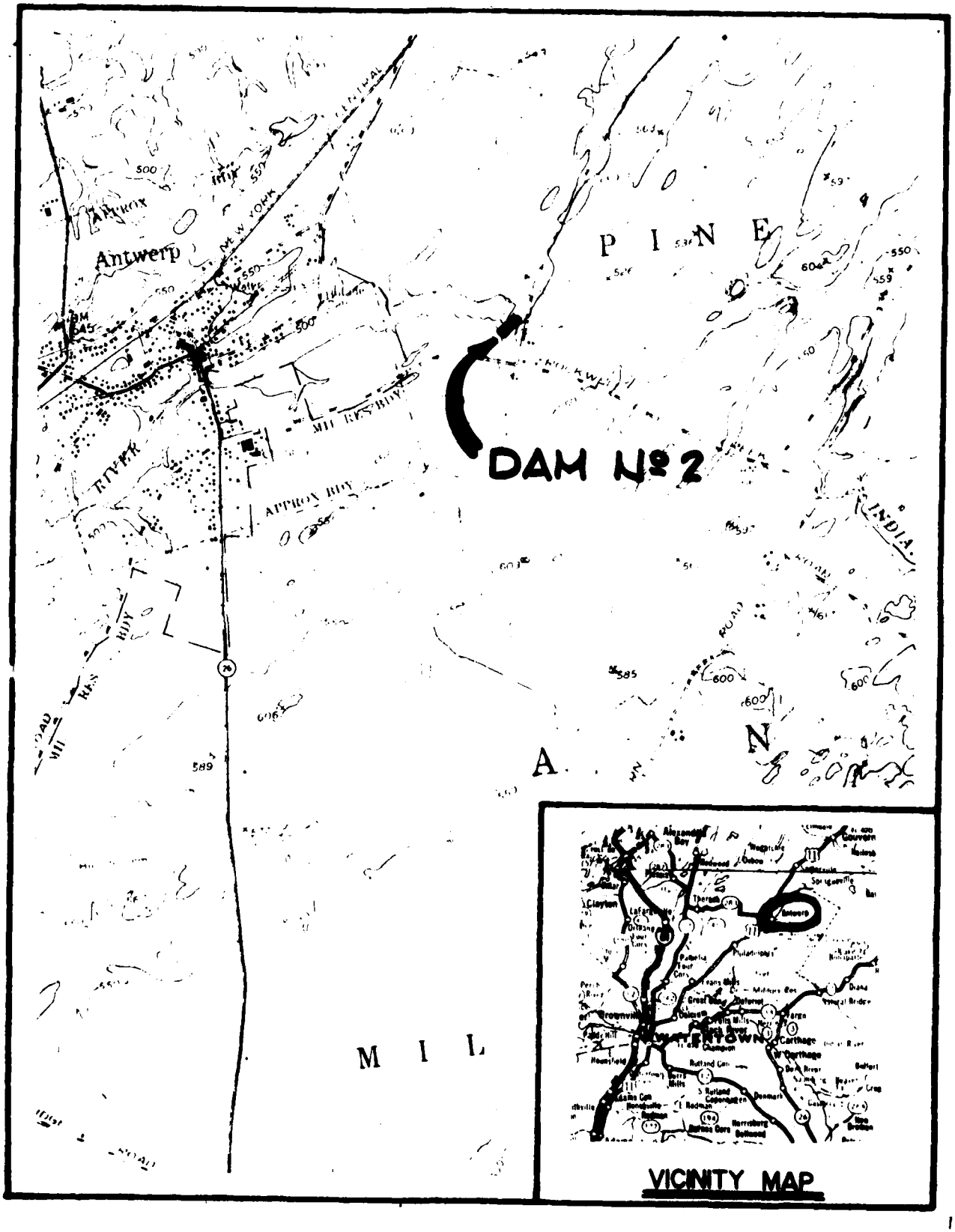
d. Need for Additional Information

Additional topographic and hydrological data is necessary to complete the recommended investigations. Additional information on the dam cross section and foundation conditions are also necessry to properly assess the dam stability. The interrelation of the stability with the hydraulic computations are critical to the findings of this report. More accurate data in these areas could affect these findings.

7.2 RECOMMENDED MEASURES

a. Further investigation regarding the structural stability of the dam should be undertaken. This investigation should include the evaluation of hydrostatic uplift which may exist at the foundation interface and investigation of any tiedown elements which may be presently incorporated into the dam.

b. Repairs should be made to eliminate seepage and improve structural stability at the south abutment of the masonry dam section.



LOCATION PLAN

FIGURE 1

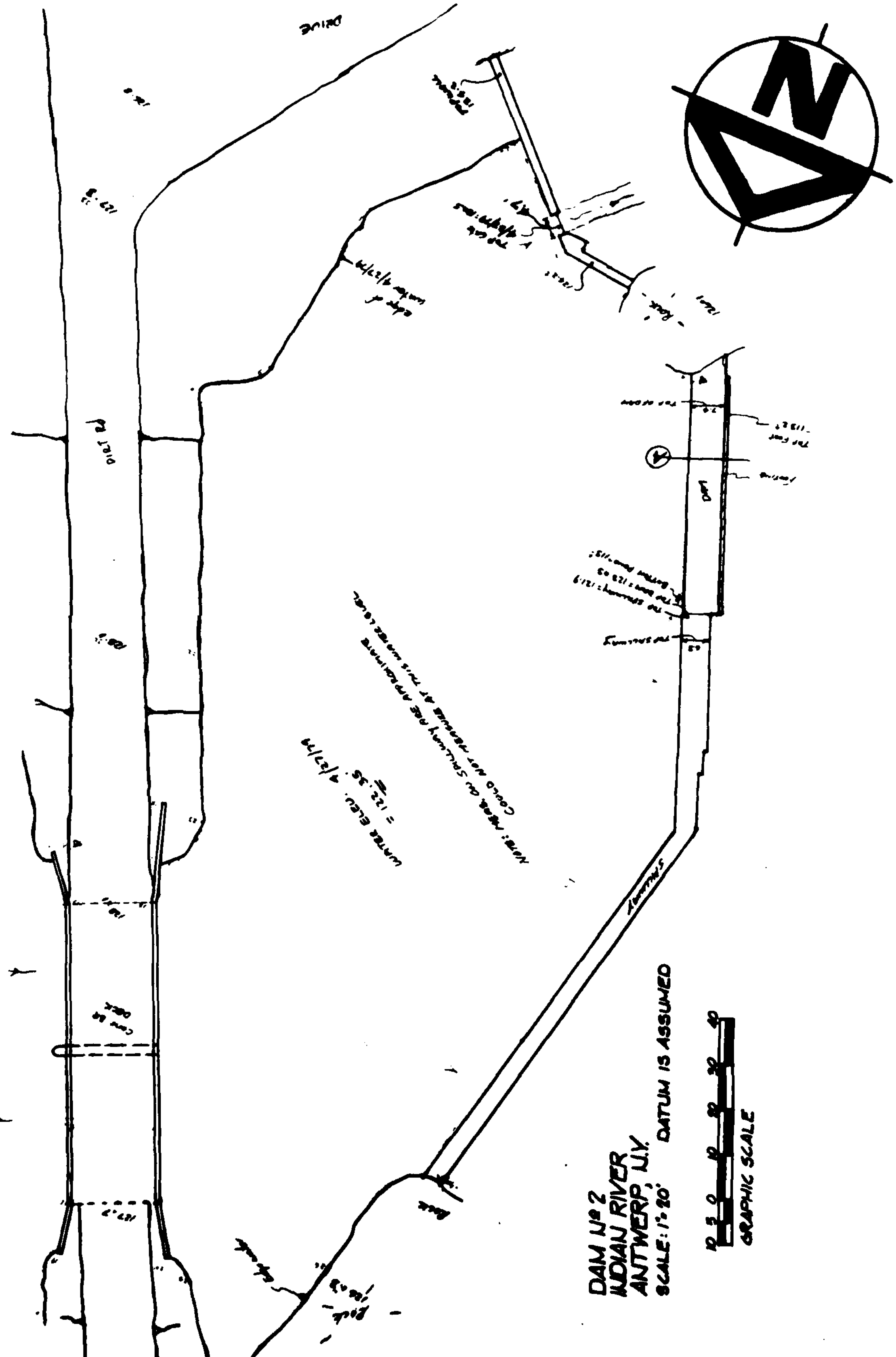
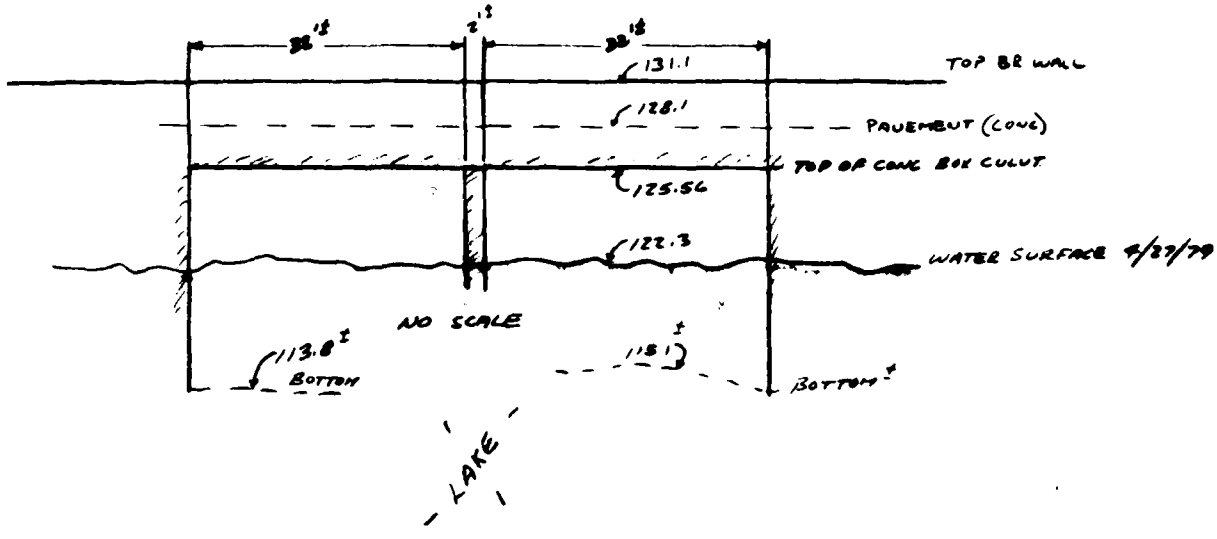
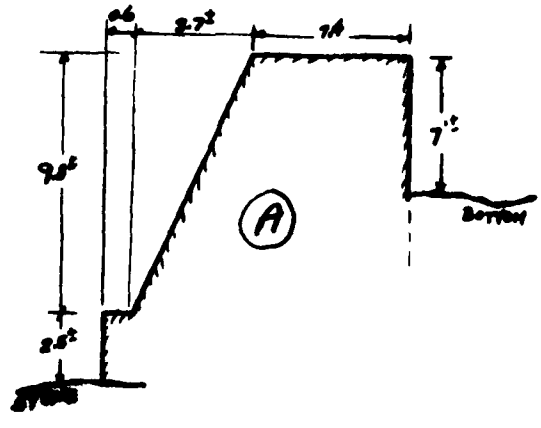

DAM No 2
INDIAN RIVER
ANTWERP, N.Y.
SCALE: 1"=20'
DATUM IS ASSUMED
GRAPHIC SCALE

FIGURE 2



BRIDGE ELEVATION



DAM SECTION

DAM Nº 2 - INDIAN RIVER
ANTWERP, N.Y.
SCALE: 1"= 20' DATUM IS ASSUMED

FIGURE 3

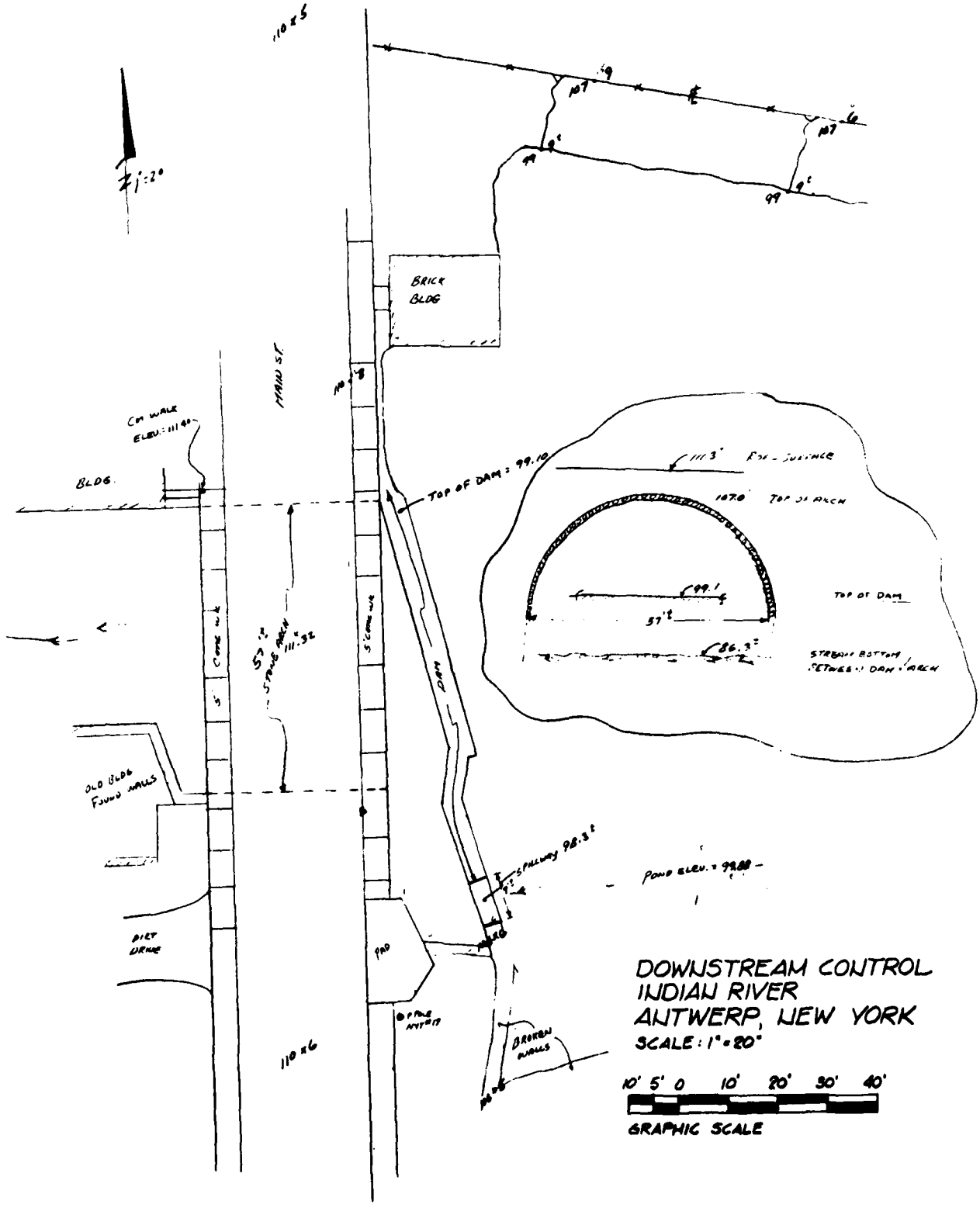
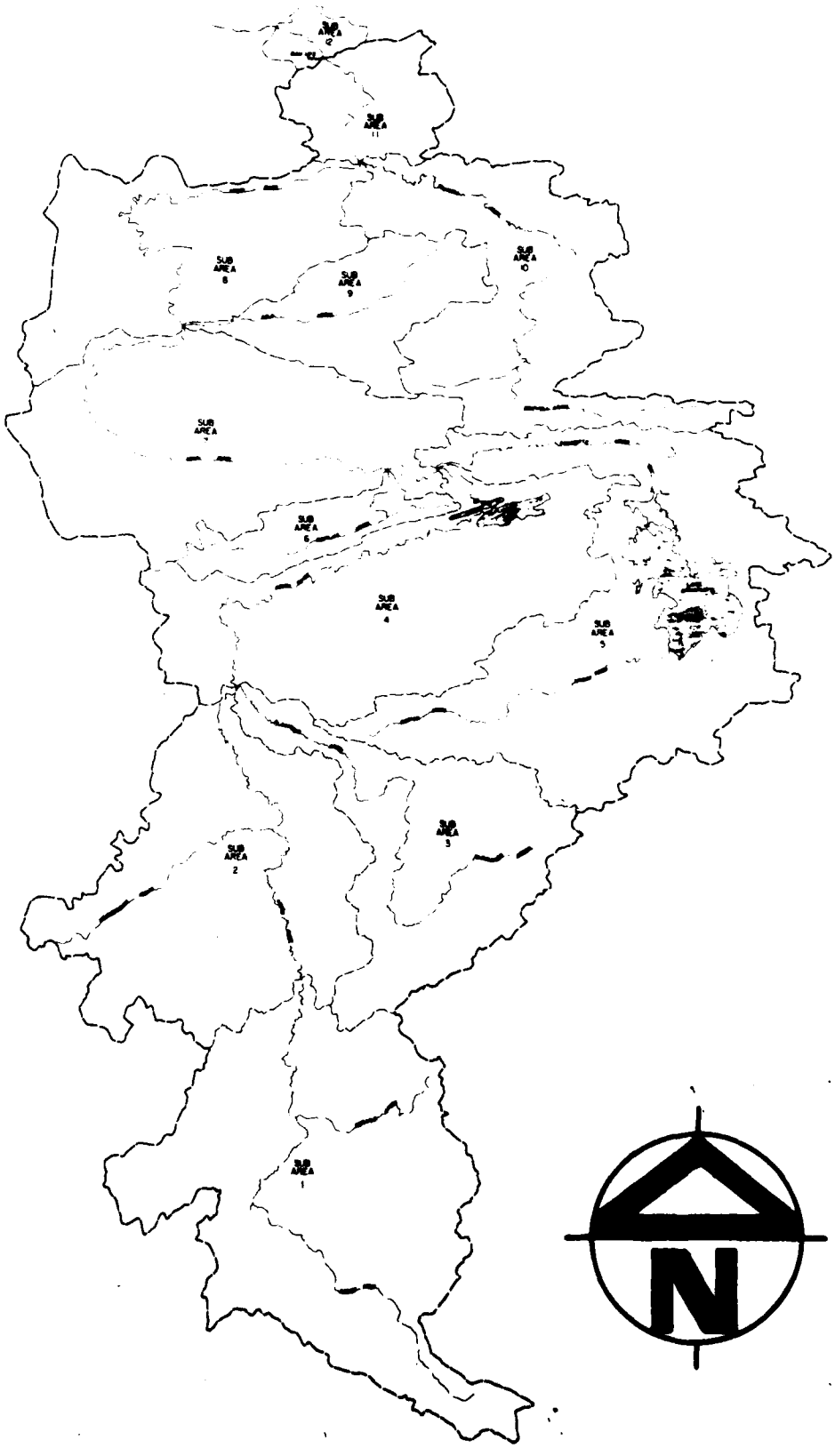
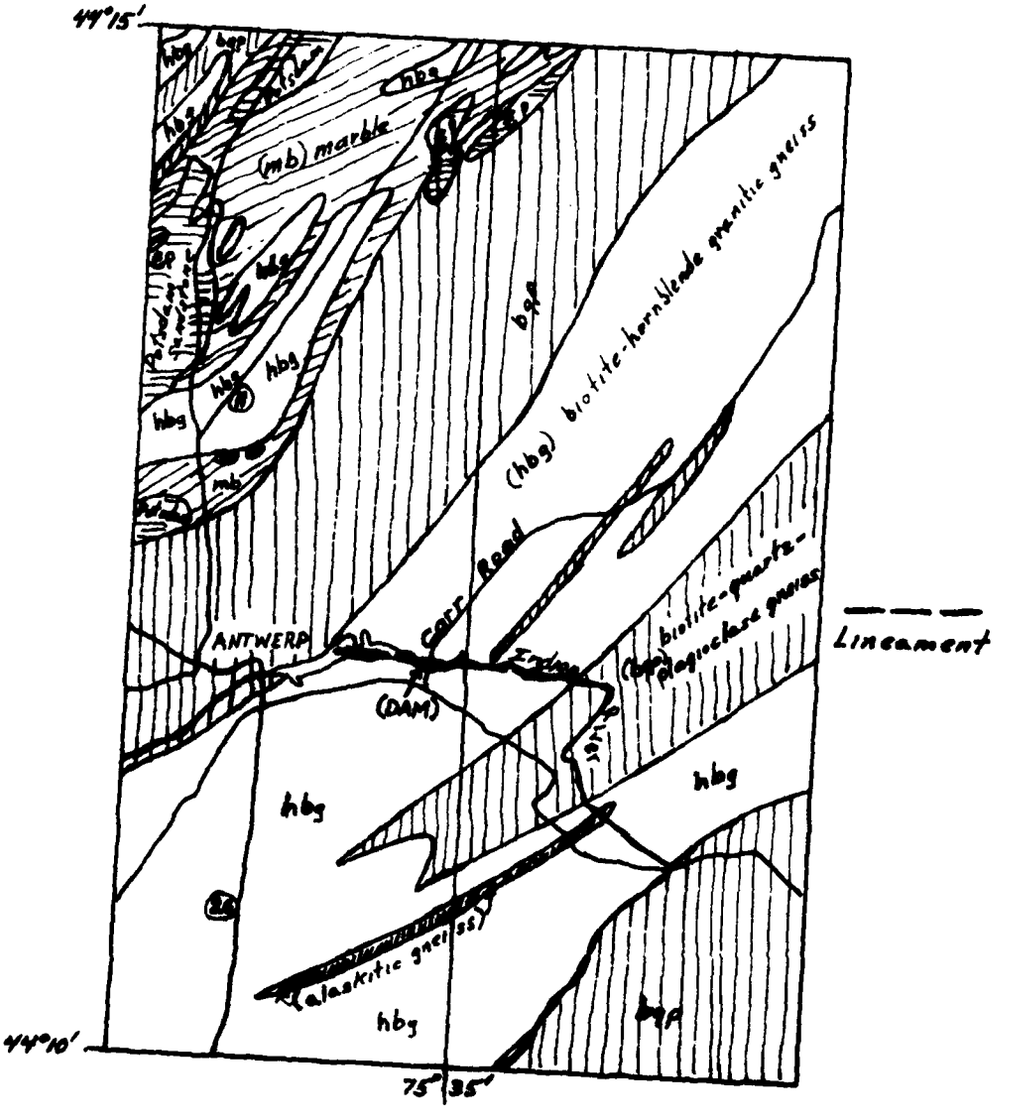

BRICK BLDG
MAIN ST
CM WALK ELEV.: 111.40
BLDG.
TOP OF DAM = 99.10
111.3' FOX - SUSTANCE
107.0' TOP OF ARCH
99.1'
57'±
86.3'±
TOP OF DAM
STREAM BOTTOM
57' ± STONE ARCH 111.32
STONE WALL
DAM
OLD BLDG FOUND WALLS
SPILLWAY 98.3'±
POND ELEV. = 99.00
DIRT DRIVE
PAD
BROKEN WALLS
110±6
110±5
DOWNSTREAM CONTROL
INDIAN RIVER
ANTWERP, NEW YORK
SCALE: 1" = 20'
10' 5' 0 10' 20' 30' 40'
GRAPHIC SCALE

FIGURE 4



DRAINAGE BASIN PLAN

PLATE 5



GEOLOGIC MAP

APPENDIX A

FIELD INSPECTION REPORT

CHECK LIST
VISUAL INSPECTION

PHASE 1

Name Dam: Dam No. 2 | Town: Antwerp | County: Jefferson | State: N.Y. | ID #: 345

Type of Dam: Concrete | Hazard Category: Significant

Date(s) Inspection: May 2, 1979 | Weather: Fair | Temperature:

Pool Elevation at Time of Inspection: 122.4 M.S.L. | Tailwater at Time of Inspection: Below Rapids

Inspection Personnel:

F. W. Byszewski	Stetson-Dale	
F. D. McCarthy	Stetson-Dale	
N. F. Dunlevy	Stetson-Dale	

N. F. Dunlevy — Recorder

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Along south abutment at contact with rock foundation. Water at base of dam from spillway discharge.	Flow between base of masonry stone section and bedrock outcropping. Height of section - 6 feet, length of seep - 10 feet.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	See above description of seepage. Abutment is largely bedrock.	
DRAINS	None noticeable	
WATER PASSAGES	Stop plank service spillway exists near south abutment.	
FOUNDATION	None	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	None. Concrete in good condition.	Area water spillway looks in good condition.
STRUCTURAL CRACKING	None	Seepage in between bedrock and masonry contact.
VERTICAL & HORIZONTAL ALIGNMENT	Good Condition.	
MONOLITH JOINTS	None	
CONSTRUCTION JOINTS	---	
STAFF GAGE OF RECORDER	---	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	N/A	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	N/A	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	N/A	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	N/A	
RIPRAP FAILURES	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	N/A	
ANY NOTICEABLE SEEPAGE	N/A	
STAFF GAGE AND RECORDER	N/A	
DRAINS	N/A	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Founded on bedrock. At time of inspection under 6 inches of water.	
APPROACH CHANNEL	Head of Dam	Bridge crosses reservoir 300 feet above dam.
DISCHARGE CHANNEL	On bedrock. Well graded, rapids.	
BRIDGE AND PIERS	No bridge on dam - a bridge crosses the reservoir 300 feet just upstream of dam.	

GATED SPILLWAY

(Stop Plank Operated Sluiceway)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Submerged. About 12-16 inch discharge.	
APPROACH CHANNEL	Head of dam.	
DISCHARGE CHANNEL	Rock spillway, well graded, rapids.	
BRIDGE AND PIERS	--	
GATES AND OPERATION EQUIPMENT	At time of inspection stop planks were all removed.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None	
INTAKE STRUCTURE	None	
OUTLET STRUCTURE	None	
OUTLET CHANNEL	None	
EMERGENCY GATE	None	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Unobstructed flow, bedrock. Whole logs piled into channel, no obstruction however.	
SLOPES	Well graded, rapids.	
APPROXIMATE NO. OF HOMES AND POPULATION	Village of Antwerp homes on lake below dam. Hazard at residential and commercial structure adjacent to bridge in Village.	Structures parallel to lake are about 20 feet above spillway level. Structures normal to lake on street that bridges spillway is much lower and is a potentially high hazard area.

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	N/A	
OBSERVATION WELLS	N/A	
WEIRS	N/A	
PIEZOMETERS	N/A	
OTHER	N/A	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Flat terrain adjacent to reservoir.	
SEDIMENTATION	Unknown	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

NAME OF DAM Dam No. 2

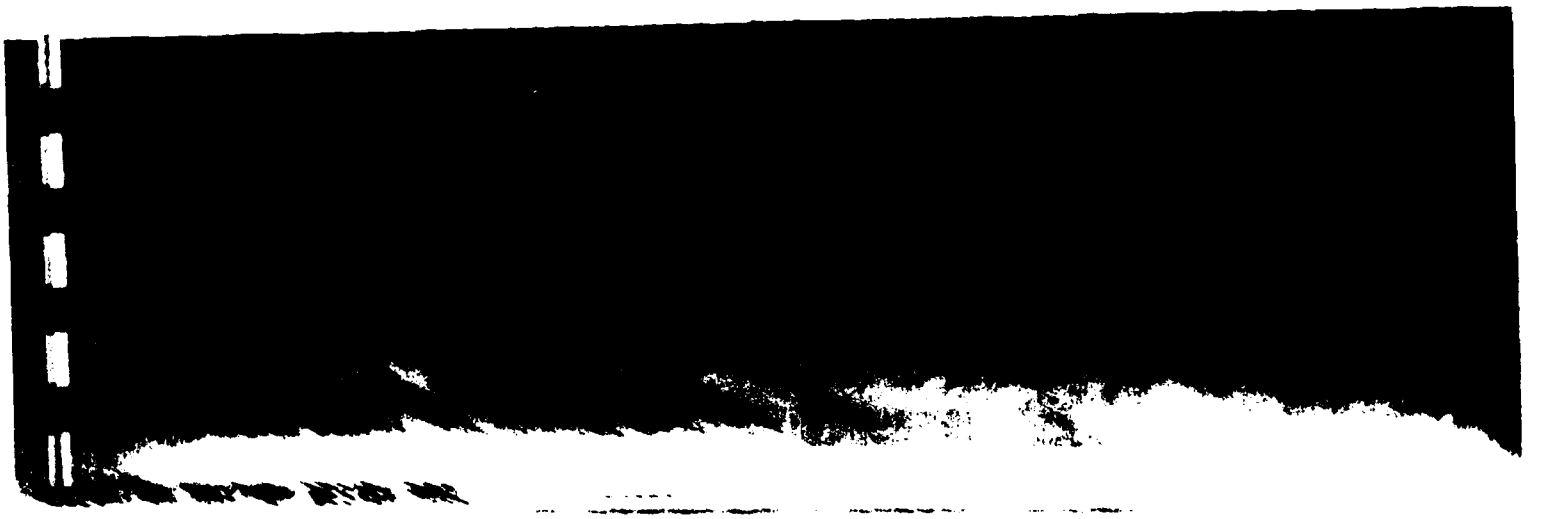
ID # 345

ITEM	REMARKS
AS-BUILT DRAWINGS	None
REGIONAL VICINITY MAP	See this report.
CONSTRUCTION HISTORY	Unknown
TYPICAL SECTIONS OF DAM	See information prepared for this report.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	No data.
RAINFALL/RESERVOIR RECORDS	No data.

ITEM	REMARKS
DESIGN REPORTS	No data.
GEOLOGY REPORTS	No data.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No data.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	No data.
POST-CONSTRUCTION SURVEYS OF DAM	See information prepared for this report.
BORROW SOURCES	No data.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	No data.
HIGH POOL RECORDS	No data.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	No data.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	No data.
MAINTENANCE OPERATION: RECORDS	No data.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	No data.
OPERATING EQUIPMENT PLANS & DETAILS	No data.



c. Length [illegible] feet

e. Location Spillover Full width of dam.

f. Number and Type of Gates Stop log sluiceway (logs not in place)

OUTLET WORKS:

a. Type Stop logs sluiceway mentioned above.

b. Location South abutment area of dam

c. Entrance Inverts

d. Exit Inverts same

e. Emergency Draindown Facilities --

HYDROMETEOROLOGICAL GATES:

a. Type None

b. Location None

c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: No data.

APPENDIX B

PREVIOUS INSPECTION REPORTS/RELEVANT CORRESPONDENCE

345 Cochise

(NOTICE: After filing out one of these forms as completely as possible for each dam in your district, return it at once to the Conservation Commission, Albany.)

RECEIVED
SEP 2 1914
DIVISION INLAND WATERS
J. D. M.

STATE OF NEW YORK
CONSERVATION COMMISSION
ALBANY

B

DAM REPORT

Sept. 21, 1914
(Date)

CONSERVATION COMMISSION,

DIVISION OF INLAND WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as the Sterlingburg Dam.

This dam is situated upon the Indian River
(Give name of stream)
in the Town of Antwerp, Jefferson County,
about 3/4 miles from the Village ~~or City~~ of Antwerp.
(State distance)
The distance up stream from the dam, to the Sterlingburg Bridge,
(Up or down) (Give name of nearest important stream or of a bridge)
is about 100 feet.
(State distance)

The dam is now owned by W. A. Brooks, Philadelphia, N.Y.
Give name in full)
and was built in or about the year 1885, and was ~~entirely repaired~~ reconstructed during the year 1912.

As it now stands, the spillway portion of this dam is built of concrete & stone
(State whether of masonry, concrete or timber)
and the other portions are built of concrete and stone.
(State whether of masonry, concrete, earth or timber with or without rock fill)

As nearly as I can learn, the character of the foundation bed under the spillway portion of the dam is solid rock and under the remaining portions such foundation bed is solid rock.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DAM INSPECTION REPORT
(By Visual Inspection)

Dam Number	River Basin	Town	County	Hazard Class*	Date & Inspector
345	Oswego	Antwerp	Jefferson	B	5/28/75 [illegible]

Type of Construction

- ☐ Earth w/concrete spillway
- ☐ Earth w/drop inlet pipe
- ☐ Earth w/stone or riprap spillway
- ☒ Concrete
- ☐ Stone
- ☐ Timber

Use

- ☐ Water Supply
- ☐ Power
- ☒ Recreation
- ☒ Fish and Wildlife
- ☐ Farm Pond
- ☐ No Apparent Use-Abandoned

Estimated Impoundment Size

- ☐ 1-5 acres
- ☐ 5-10 acres
- ☒ Over 10 acres

Estimated Height of Dam above Streambed

- ☒ Under 10 feet
- ☐ 10-25 feet
- ☐ Over 25 feet

Condition of Spillway

- ☒ Service satisfactory
- ☐ In need of repair or maintenance
- ☒ Auxiliary satisfactory
- ☐ In need of repair or maintenance

Explain: _____

_____

Condition of Non-Overflow Section

- ☒ Satisfactory
- ☐ In need of repair or maintenance Explain: _____

_____

Condition of Mechanical Equipment

- ☐ Satisfactory none
- ☐ In need of repair or maintenance Explain: _____

_____

Evaluation (From Visual Inspection)

- ☒ No defects observed beyond normal maintenance
- ☐ Repairs required beyond normal maintenance

*Explain Hazard Class, if Necessary Very old dam Mill pond

B-2

? ENVIRONMENTAL CONSERVATION
TION REPORT
Inspection)

County	Hazard Class*	Date & Inspector
Jefferson	B	5/22/75 KH CKL

Use

- ☐ Water Supply
- ☐ Power
- ☒ Recreation
- ☒ Fish and Wildlife
- ☐ Farm Pond
- ☐ No Apparent Use-Abandoned

- ☐ Stone
- ☐ Timber

Estimated Impoundment Size

- ☐ 1-5 acres
- ☐ 5-10 acres
- ☒ Over 10 acres

Estimated Height of Dam above Streambed

- ☒ Under 10 feet
- ☐ 10-25 feet
- ☐ Over 25 feet

Condition of Spillway

- ☒ Service satisfactory
- ☐ In need of repair or maintenance
- ☒ Auxiliary satisfactory
- ☐ In need of repair or maintenance

Explain: _____

_____

Condition of Non-Overflow Section

- ☒ Satisfactory
- ☐ In need of repair or maintenance Explain: _____

_____

Condition of Mechanical Equipment

- ☐ Satisfactory None
- ☐ In need of repair or maintenance Explain: _____

_____

Evaluation (From Visual Inspection)

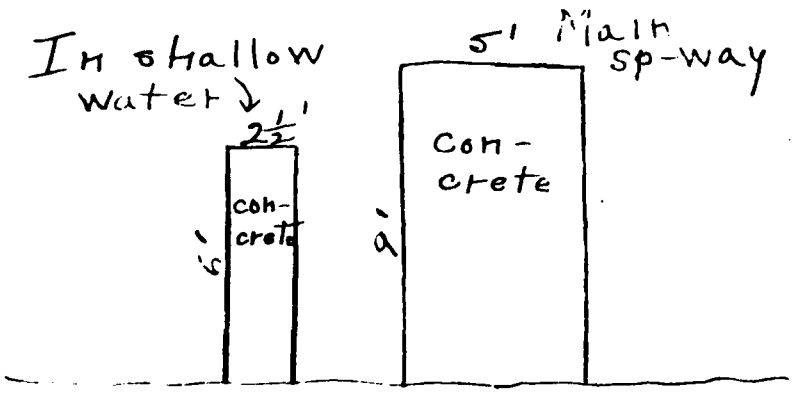
- ☒ No defects observed beyond normal maintenance
- ☐ Repairs required beyond normal maintenance

*Explain Hazard Class, if Necessary Very old dam Mill gone

CR-6 (10/74)

(In the space below, make one sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the greatest height of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)

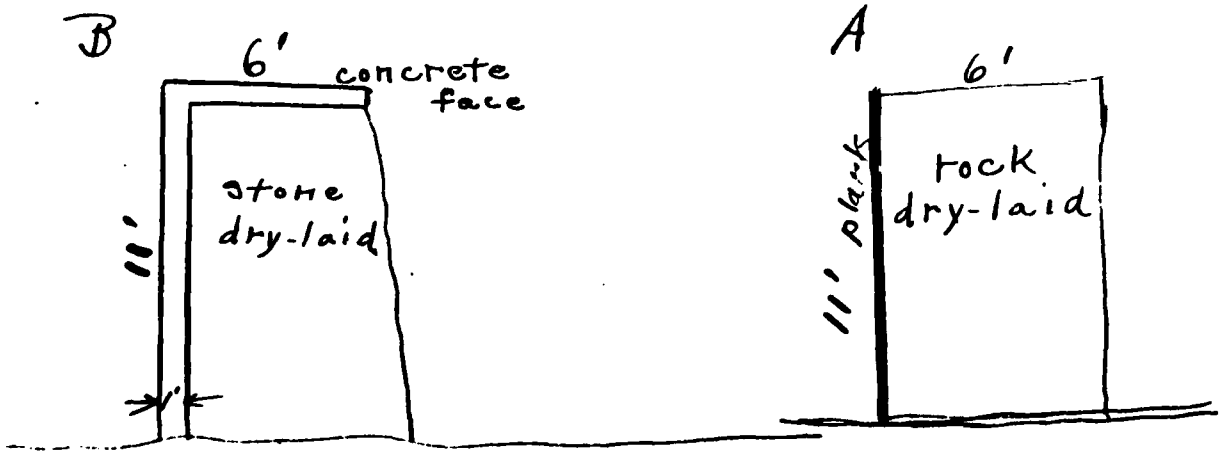
Spillway sections—



(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings or other conspicuous objects in the vicinity.

Section through 30' wall containing waste gate

Wall across to mill from island



The total length of this dam is 155 feet. The spillway or waste-weir portion, is about 85 feet long, and the crest of the spillway is about 5 feet below the top of the dam.

The number, size and location of discharge pipes, waste pipes or gates which may be used for drawing off the water from behind the dam, are as follows: One waste gate 5' deep and 2½' wide (see general view.)

State briefly, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly any leaks or cracks which you may have observed.)

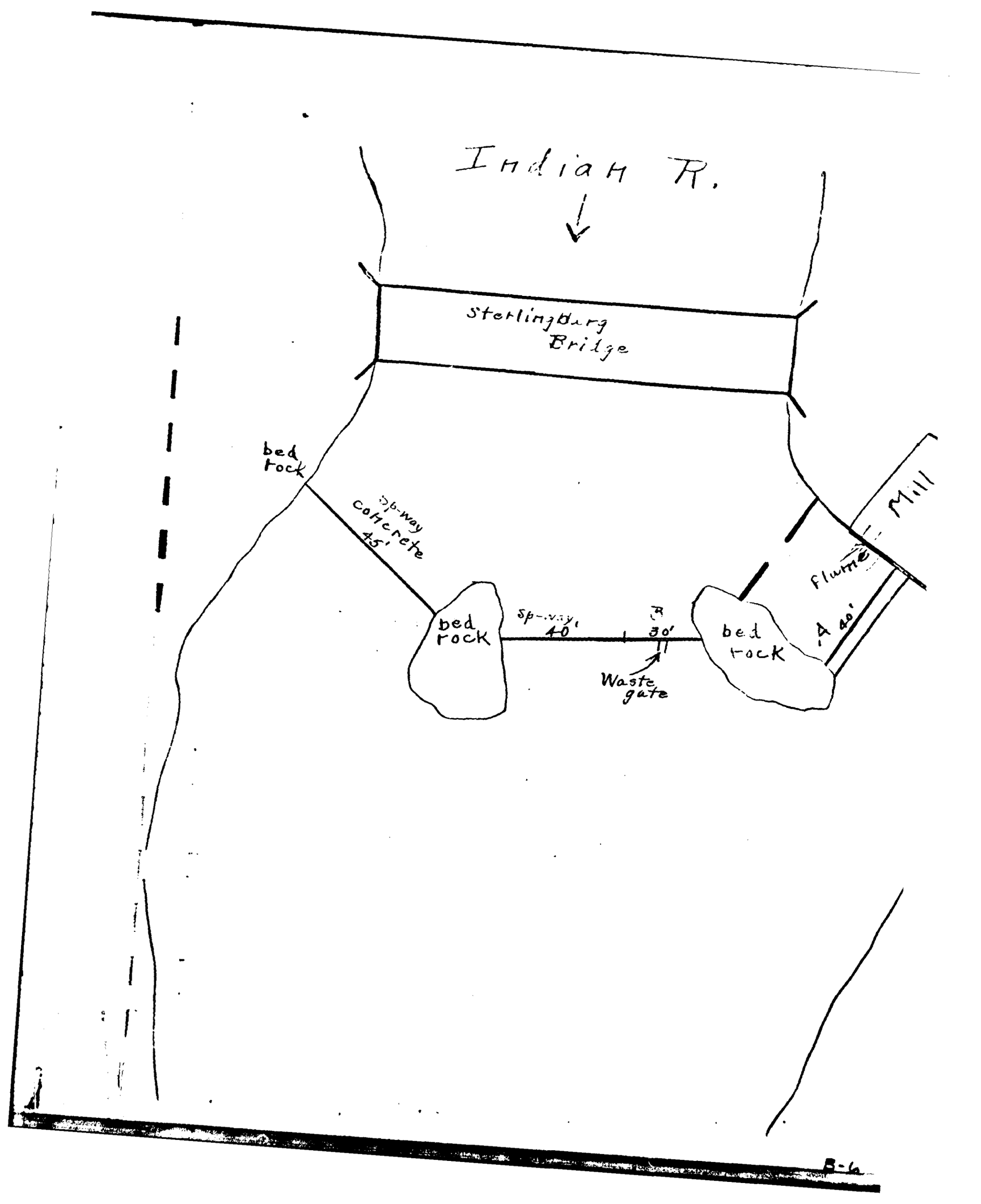
This dam is in good condition and does not leak.

Reported by C. W. Douglass,
(Signature)

115 Standart St.,
(Address—Street and number, P. O. Box or R. F. D. route)

Syracuse, N. Y.
(Name of place)

(SEE OTHER SIDE)


Indian R.
Sterlingburg Bridge
bed rock
Sp-way concrete 45'
bed rock
Sp-way 40'
30'
Waste gate
bed rock
Flume
40'
Mill

APPENDIX C

HYDROLOGY AND HYDRAULICS

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800

DESIGN BRIEF

PROJECT NAME NEW YORK STATE DAM INSPECTION DATE 5.4.79

SUBJECT DAM Nº 2 (VIC ANTWERP) FORT DRUM, NY PROJECT NO. 2277

ESTIMATE OF CLARK'S PARAMETERS DRAWN BY JPG

ESTIMATE OF T_c

ASSUME: $R/(T_c+R) =$
$R = T_c$ *

$T_c = 11.9\ (L^3/H)^{.385}$

		L (MI.)	H (FT)	T_c & R
SUB AREA	1	13.598	415	23.81
" "	2	7.670	178	17.02
" "	3	10.417	178	24.25
" "	4	8.712	215	18.34
" "	5	14.394	215	32.75
" "	6	6.004	125	14.70
" "	7	9.091	155	21.85
" "	8	8.475	95	24.33
" "	9	5,682	90	15.65
" "	10	15,379	255	33.11
" "	11	2.652	109	6.03
" "	12	.871	100	1.72

SCS

$L = \dfrac{l^{.8}\,(S+1)^{.7}}{1900\,Y^{.5}}$ $\quad T_c = L/.6$ $\quad S = \dfrac{1000}{CN} - 10$

		l' (FT)	S	Y (%)	L	T_c & R (Hrs)
SUB AREA	1	71800	4.706	4	6.832	11.39
" "	2	40500	4.286	3	4.730	7.88
" "	3	55000	4.706	3	6.374	10.62
" "	4	46000	4.286	3	5.237	8.73
" "	5	76000	4.286	5	6.062	10.10
" "	6	31700	3.889	3	3.681	6.14
" "	7	48000	3.889	3	5.130	8.55
" "	8	44750	4.493	3	5.262	8.77
" "	9	30000	4.706	3	3.924	6.54
" "	10	82000	3.889	3	7.874	13.12
" "	11	14000	3.889	4	1.658	2.76
" "	12	4600	3.889	4	.681	1.13

CH

* NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY FEBRUARY 1972

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501 TEL 315-797-5800

DESIGN BRIEF

PROJECT NAME New York State Dam Inspection DATE 5.7.79

SUBJECT Dam No 2 (vic Antwerp) Fort Drum, NY PROJECT NO 2277

Estimate of Snyder's Parameters DRAWN BY JPG

640 C_p

C_p is .625 for Sub Area 1 thru 12

$t_p = C_t (L \cdot L_{CA})^{.3}$

	C_t	L(mi)	L_{CA}(mi)	t_p
Sub Area 1	2.0	13.598	3.69	6.47
" " 2	2.0	7.670	3.31	5.23
" " 3	2.0	10.417	4.45	6.32
" " 4	2.0	8.712	3.13	5.39
" " 5	2.0	14.394	7.29	8.08
" " 6	2.0	6.004	1.80	4.08
" " 7	2.0	9.0911	2.18	4.90
" " 8	2.0	8.475	3.13	5.35
" " 9	2.0	5.682	3.03	4.70
" " 10	2.0	15.379	4.54	7.15
" " 11	2.0	2.652	1.04	2.71
" " 12	2.0	.871	.75	1.76

$t_r = t_p / 5.5$

	t_p	t_r
Sub Area 1	6.47	1.18
" " 2	5.23	.95
" " 3	6.32	1.15
" " 4	5.39	.98
" " 5	8.08	1.47
" " 6	4.08	.74
" " 7	4.90	.89
" " 8	5.35	.97
" " 9	4.70	.85
" " 10	7.15	1.30
" " 11	2.71	.49
" " 12	1.76	.32

$t_{pr} = t_p + .25 (t_R - t_r)$

	t_p	t_R	t_r	t_{pr}
Sub Area 1	6.47	1.0	1.18	6.43
" " 2	5.23	1.0	.95	5.24
" " 3	6.32	1.0	1.15	6.28
" " 4	5.39	1.0	.98	5.39
" " 5	8.08	1.0	1.47	7.96
" " 6	4.08	1.0	.74	4.15
" " 7	4.90	1.0	.89	4.93
" " 8	5.35	1.0	.97	5.35
" " 9	4.70	1.0	.85	4.74
" " 10	7.15	1.0	1.30	7.08
" " 11	2.71	1.0	.49	2.84
" " 12	1.76	1.0	.32	1.93

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DESIGN BRIEF

PROJECT NAME NEW YORK STATE DAM INSPECTION DATE 5.4.79

SUBJECT DAM Nº 2 (VIC ANTWERP) FORT DRUM, NY PROJECT NO 2277

CALCULATION OF WEIGHTED CN DRAWN BY JPG

SUB AREA 1

83 x 10 = 830

66 x 90 = 5940

6770 ÷ 100 = 68

SUB AREA 2

83 x 22 = 1826

66 x 78 = 5148

6974 ÷ 100 = 70

SUB AREA 3

83 x 14 = 1162

66 x 86 = 5673

6838 ÷ 100 = 68

SUB AREA 4

83 x 21 = 1743

66 x 79 = 5214

6957 ÷ 100 = 70

SUB AREA 5

83 x 23 = 1909

66 x 77 = 5082

6991 ÷ 100 = 70

SUB AREA 8

83 x 15 = 1245

66 x 85 = 5610

6855 ÷ 100 = 69

SUB AREA 9

83 x 10 = 830

66 x 90 = 5940

6770 ÷ 100 = 68

STETSON • DALE BANKERS TRUST BUILDING UTICA • NEW YORK • 13501
TEL 315-797-5800

DESIGN BRIEF

PROJECT NAME New York State Dam Inspection DATE 5.3.79
SUBJECT Dam No 2 (vic Antwerp) Fort Drum, NY PROJECT NO 2277
Depth-Duration Relationship DRAWN BY JPG

Hydrometeorological Report No 33

PMP Index Rainfall
200 Sq Mi
24 Hr - 18.5"

Duration	%	Depth
6 Hr	85	15.73
12 Hr	97	17.95
24 Hr	105	19.43
48 Hr	120	22.22

```
(0001)   A1 DAM NO 2  (ANTWERP)
(0002)   A2 HEC-1DB
(0003)   A3 FREE-DAM OVERTOPPING ANALYSIS
(0004)   E      90        1         0         0         0         0         0         4
(0005)   B1      5
(0006)   J       1         5         1
(0007)   J1     .2        .4        .5        .6        .8       1.0
(0008)   K       0         1         0         0         0         0         1
(0009)   K1   SUB AREA 1 RUNOFF    CLARK'S PARAMETERS
(0010)   M       1         0      3.62         0    152.1         0         0         0         1
(0011)   P       0      10.5        55        97       105       120
(0012)   T       0         0         0         0         0         0         1       0.1
(0013)   V   11.57     11.39
(0014)   X       4         5         1
(0015)   K       1         2         0         0         0         0         1
(0016)   K1   CHANNEL ROUTE THRU AREA 2
(0017)   Y       1         0         1         1
(0018)   Y1      1         0         0         0         0         0        -1
(0019)   Y6    .05       .04       .04       822       850     40500     .0003
(0020)   Y7    150       850       300       840       380       830       40       822       420       822
(0021)   Y7    450       950       875       840       150       850
(0022)   K       2         1         0         0         0         0         1
(0023)   K1   SUB AREA 2 RUNOFF
(0024)   M       1         0     18.11         0    152.1         0         0         0         1
(0025)   P       0      18.5        55        97       105       120
(0026)   T       0         0         0         0         0         0         1       0.1
(0027)   V    7.05      7.05
(0028)   X      56        56         1
(0029)   K       3         2         0         0         0         0         1
(0030)   K1 SUB AREA 3 RUNOFF
(0031)   M       1         0     11.43         0    152.1         0         0         0         1
(0032)   P       0      18.5        55        97       105       120
(0033)   T       0         0         0         0         0         0         1       0.1
(0034)   V   10.42     10.42
(0035)   X      24        24         1
(0036)   K       3         2         0         0         0         0         1
(0037)   K1   COMBINE 3 HYDROGRAPHS AT 2
(0038)   K       1         3         0         0         0         0         1
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(0039)   K1  CHANNEL ROUTE THRU AREA 4
(0040)   Y       0       0       0       1       1
(0041)   Y1      1       0       0       0       0       0      -1
(0042)   Y6    .08     .64      .0      685     710     460     .005
(0043)   Y7   100     710     130      700     150     650     475     685     525     685
(0044)   Y7   850     690     900      700     925     710
(0045)   K       4       4       0       0       0       0       1
(0046)   K1  SUB AREA 4 RUNOFF
(0047)   A       1       0   17.37       0   152.1       0       0       0       1
(0048)   I               18.5      85      97     105     120
(0049)   T       0       0       0       0       0       0       1     0.1
(0050)   V    0.73    0.73
(0051)   X      54      54       1
(0052)   K       5       5       0       0       0       0       1
(0053)   K1  SUB AREA 5 RUNOFF
(0054)   A       1       0   19.05       0   152.1       0       0       0       1
(0055)   I       0    12.5      .5      97     105     120
(0056)   T       0       0       0       0       0       0       1     0.1
(0057)   V   10.1    10.1
(0058)   X      41      41       1
(0059)   K       5       5       0       0       0       0       1
(0060)   K1  COMBINE 5 HYDROGRAPHS AT 5
(0061)   K       1       4       0       0       0       0       1
(0062)   K1  CHANNEL ROUTE TO    AREA 7
(0063)   Y       0       0       0       1       1
(0064)   Y1      1       0       0       0       0       0      -1
(0065)   Y6    .08     .64      .0      685     760     [illegible]     .005
(0066)   Y7   100     720     150      710     375     700     450     685     560     685
(0067)   Y7  1000     700    1500      710    1550     720
(0068)   K       6       6       0       0       0       0       1
(0069)   K1  SUB AREA 6 RUNOFF
(0070)   A       1       0    3.16       0   152.1       0       0       0       1
(0071)   I       0    12.5      .5      97     105     120
(0072)   T       0       0       0       0       0       0       1     0.1
(0073)   V    0.14    0.14
(0074)   X       4       4       1
(0075)   K       4       4       0       0       0       0       1
(0076)   K1  COMBINE 4 HYDROGRAPHS AT 4
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(0077)   K       1       5       0       0       0                1
(0078)   K1 CHANNEL ROUTE THRU AREA 7
(0079)   Y       0       0       0       1       1
(0080)   Y1      1       0       0       0       0       0       -1
(0081)   Y6    .08     .04     .04     595     620    4350    .002
(0082)   Y7   1100     620     300     610     450     600     500     595     600     595
(0083)   Y7    620     500     650     610    1000     620
(0084)   K       0       7       0       0       0       0       1
(0085)   K1 SUB AREA 7 RUNOFF
(0086)   M       1       0   17.15       0   152.1       0       0       0       1
(0087)   P       0    10.5       5      97     105     120
(0088)   T       0       0       0       0       0       0       1     0.1
(0089)   V    8.55    8.55
(0090)   X      34      34       1
(0091)   K       8       8       0       0       0       0       1
(0092)   K1 SUB AREA 8 RUNOFF
(0093)   M       1       0   5.998       0   152.1       0       0       0       1
(0094)   P       0    10.5       5      97     105     120
(0095)   T       0       0       0       0       0       0       1     0.1
(0096)   V    6.54    6.54
(0097)   X      12      12       1
(0098)   K       5       5       0       0       0       0       1
(0099)   K1  COMBINE 5 HYDROGRAPHS AT 5
(0100)   K       1       0       0       0       0       0       1
(0101)   K1  CHANNEL ROUTE THRU AREA 0
(0102)   Y       0       0       0       1       1
(0103)   Y1      1       0       0       0       0       0       -1
(0104)   Y6    .08     .04     .04     565     600    4475    .0007
(0105)   Y7   1100     620     200     590     350     500     500     565     700     565
(0106)   Y7    870     590     850     590     900     600
(0107)   K       5       5       1       0       0       0       1
(0108)   K1  SUB AREA 5 RUNOFF
(0109)   M       1       0   11.76       0   152.1       0       0       0       1
(0110)   P            10.5       5      97     105     120
(0111)   T       0       0       1       0       0       0       1     0.1
(0112)   V    5.77    5.77
(0113)   X      24      24       1
(0114)   K               1       0       0       0       0       1
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```
(0115)   K1  SUB AREA 10 RUNOFF
(0116)   *       1       0     13.9       0     152.1       0       0       0       1
(0117)   P       0     18.5      .5      97       105     120
(0118)   T       0        0       0       0         0       0       1     0.1
(0119)   V   13.12    13.12
(0120)   X      20       20       1
(0121)   K       3        0       0       0         0       0       1
(0122)   K1  COMBINE 3 HYDROGRAPHS AT 6
(0123)   K       1        7       0       0         0       0       1
(0124)   K1  CHANNEL ROUTE THRU AREA 11
(0125)   Y       0        0       0       1         1
(0126)   Y1      1        0       0       0         0       0      -1
(0127)   Y6    .04      .04     .08     514       530  140000    .004
(0128)   Y7    100      530     250     525       400     520     525     514     600     514
(0129)   Y7    900      520    1000     525      1100     530
(0130)   K       6       11       0       0         0       0       1
(0131)   K1  SUB AREA 11 RUNOFF
(0132)   *       1       0    4.05       0     152.1       0       0       0       1
(0133)   P       2     18.5      .5      97       105     120
(0134)   T       0        0       0       0         0       0       1     0.1
(0135)   V    2.74     2.74
(0136)   X       8        9       1
(0137)   K       2        7       0       0         0       0       1
(0138)   K1  COMBINE 2 HYDROGRAPHS AT 7
(0139)   K       1        7       0       0         0       0       1
(0140)   K1  ROUTE OVER DAM NO 2 (VIC ANTWERP)
(0141)   Y       0        0       1       1         1
(0142)   Y1      1        0       0       0         0       0    -514
(0143)   S5      1       10      36      70       140     242     410     1120
(0144)   S5  505.4      510     514     516       518     520     525      530
(0145)   S5    514      142     3.2     1.5
(0146)   S0    515     2.64     1.5    1000
(0147)   K       0       12       0       0         0       0       1
(0148)   K1  SUB AREA 12 RUNOFF
(0149)   *       1       0    1.13       0     152.1       0       0       0       1
(0150)   P       2     18.5      .5      97       105     120
(0151)   T       0        0       0       0         0       0       1     0.1
(0152)   V    1.13     1.13
```

A1 DAM NO 2 (ANTWERP)


```
(0153)   $      <       <       1
(0154)   K      <       0       1       0       0       0       1
(0155)   K1  COMBINE 2 HYDROGRAPHS AT P
(0156)   K      1       <       1       0       0       0       1
(0157)   K1        ROUTE OVER DAM AT ANTWERP
(0158)   Y      0       0       0       1       1
(0159)   Y1     1
(0160)   Y4  490.3     495     495     497     500     502  -490.5      -1
(0161)   Y5      0     700    1900    3500    6550    8000   10000   13000   32000   70000
(0162)   $S      .      90     175     265     420     560     660     765    1250    2470
(0163)   $E  490.5     495     495     497     500     502   503.5     505     510     518
(0164)   $$  490.5
(0165)   $D  491.1    2.04     1.5     0.1
(0166)   K      99
(0167)   A
(0168)   A
(0169)   A
(0170)   A
(0171)   A
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
RUNOFF HYDROGRAPH AT	1
RUNOFF HYDROGRAPH AT	3
COMBINE 2 HYDROGRAPHS AT	2
ROUTE HYDROGRAPH TO	3
RUNOFF HYDROGRAPH AT	4
RUNOFF HYDROGRAPH AT	5
COMBINE 3 HYDROGRAPHS AT	3
ROUTE HYDROGRAPH TO	4
RUNOFF HYDROGRAPH AT	6
COMBINE 2 HYDROGRAPHS AT	4
ROUTE HYDROGRAPH TO	5
RUNOFF HYDROGRAPH AT	7
RUNOFF HYDROGRAPH AT	9
COMBINE 3 HYDROGRAPHS AT	5
ROUTE HYDROGRAPH TO	6
RUNOFF HYDROGRAPH AT	8
RUNOFF HYDROGRAPH AT	10
COMBINE 3 HYDROGRAPHS AT	6
ROUTE HYDROGRAPH TO	7
RUNOFF HYDROGRAPH AT	11
COMBINE 3 HYDROGRAPHS AT	7
ROUTE HYDROGRAPH TO	7
RUNOFF HYDROGRAPH AT	12
COMBINE 2 HYDROGRAPHS AT	8
ROUTE HYDROGRAPH TO	8

END OF NETWORK

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE?=ED= NOV 14 1979
TIME?15:22:51

DAM NO 2 (ANT=ERR)
HEC-1DB
PMF-DAM OVERTOPPING ANALYSIS

JOB SPECIFICATION

NQ	NRR	NVIS	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
9[illegible]	1	[illegible]	0	0	[illegible]	0	[illegible]	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1
RTIOS= 0.20 0.40 0.50 0.80 [illegible] 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

SUB AREA 1 RUNOFF CLARK'S PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	3.02	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
[illegible]	19.56	[illegible]	[illegible]	19.56	20.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
[illegible]	[illegible]	[illegible]	1.00	[illegible]	[illegible]	1.00	1.00	0.10	0.00	0.0

UNIT HYDROGRAPH DATA
TC= 11.39 R= 11.39 NTA= 0

RECESSION DATA

STRTG= 0.CC GRCSN= 0.CC RTIOR= 1.00

UNIT HYDROGRAPH 67 END-OF-PERIOD ORDINATES, LAG= 10.38 HOURS, CP= 0.57 VOL= 1.CC

3.	11.	23.	37.	52.	67.	82.	94.	103.	108.
109.	105.	97.	89.	81.	75.	68.	63.	57.	52.
48.	44.	40.	37.	34.	31.	28.	26.	24.	22.
20.	18.	17.	15.	14.	13.	12.	11.	10.	9.
8.	8.	7.	6.	6.	5.	5.	4.	4.	4.
3.	3.	3.	3.	2.	2.	2.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.			

C MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	30587.
										(494.)(349.)(95.)(866.13)			

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTE THRU AREA 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICUTO
2	1		1		0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	3	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

S(1)	SN(2)	SN(3)	ELEVT	ELMAX	RLNTH	SEL
0.0500	0.040.0	0.080.0	822.0	850.0	4050.0	0.0000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

1000.00	850.00	840.00	840.00	850.00	4050.00	822.00	420.00	822.00
450.00	850.00	870.00	840.00	1000.00	850.00			

STORAGE	0.00	33.71	90.04	138.99	210.56	294.75	406.13	611.27	918.36
	1650.44	2451.42	3160.30	3972.05	4844.21	5761.95	6765.38	7854.38	8989.01
OUTFLOW	0.00	26.73	93.57	204.74	359.23	568.38	872.87	1303.17	1873.91
	3556.07	4719.23	6143.4	7870.3	9969.13	12269.26	14900.65	17929.64	21063.76

STAGE	822.00	823.47	824.95	826.42	827.89	829.37	830.84	832.32	833.79
	836.74	838.21	839.67	841.15	842.63	844.10	845.58	847.05	848.53
FLOW	0.00	20.73	93.57	206.72	359.23	568.38	872.87	1303.17	1873.91
	3556.07	4719.23	6126.42	7876.05	9929.15	12269.20	14900.63	17829.64	21063.76

MAXIMUM STAGE IS 820.6

MAXIMUM STAGE IS 828.7

MAXIMUM STAGE IS 829.5

MAXIMUM STAGE IS 830.2

MAXIMUM STAGE IS 831.2

MAXIMUM STAGE IS 831.9

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

SUB AREA 2 RUNOFF

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	18.11	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	16.50	85.00	97.00	100.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.10

UNIT HYDROGRAPH DATA

TC= 7.20 R= 7.20 NTA= 0

RECESSION DATA

STRTQ= 30.00 QRCSN= 30.00 RTIOR= 1.00

UNIT HYDROGRAPH 48 END-OF-PERIOD ORDINATES, LAG= 7.10 HOURS, CP= 0.56 VOL= 1.00

45.	165.	333.	523.	7 .	650.	929.	933.	859.	756.
600.	586.	51 .	455.	4 1.	353.	311.	274.	241.	212.
187.	165.	145.	128.	112.	99.	87.	77.	68.	60.

56.	46.	41.	36.	32.	28.	24.	22.	19.	17.
15.	13.	11.	10.	9.	8.				

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.98	3.48	188974.
										(494.)	(406.)	(88.)	(5351.14)

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 3 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	3	0	0	1	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	11.63	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	10.50	5.00	7.00	10.00	12.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 10.62 R= 10.62 NTA= 5

RECESSION DATA

STRTQ= 24.00 QRCSN= 24.00 RTIOR= 1.00

UNIT HYDROGRAPH 62 END-OF-PERIOD ORDINATES, LAG= 9.69 HOURS, CP= 0.57 VOL= 1.00

14.	56.	165.	167.	254.	303.	364.	410.	446.	452.
440.	407.	376.	337.	317.	279.	254.	231.	210.	191.
174.	159.	144.	131.	119.	109.	99.	90.	82.	75.
68.	62.	56.	51.	47.	42.	39.	35.	32.	29.
26.	24.	22.	20.	18.	17.	15.	14.	12.	11.
10.	9.	9.	8.	7.	6.	6.	5.	5.	4.
4.	4.								

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	118450.

(494.)(529.)(95.)(3554.15)

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COMBINE HYDROGRAPHS

COMBINE 3 HYDROGRAPHS AT 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	3	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE THRU AREA 4

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELMVT	ELMAX	RLNTH	SEL
0.0800	0.0400	0.0800	665.0	710.0	46000.	0.00300

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

100.00 710.00 150.00 700.00 150.00 690.00 475.00 685.00 525.00 685.00
850.00 690.00 900.00 700.00 925.00 710.00

STORAGE	0.00	1002.29	2014.21	3027.76	4174.47	5155.96	6150.29	7157.39	8177.29
	9255.46	10313.76	11384.55	12465.22	13556.13	14657.11	15768.13	16889.21	18020.35
OUTFLO	.01	315.21	1543.46	4111.47	8022.76	13975.29	25051.13	35713.49	47865.05
	76356.67	92591.11	110107.9	128087.3	146822.7	165964.66	192250.75	215765.19	240168.91
STAGE	685.00	686.32	687.65	688.99	690.28	691.56	692.89	694.21	695.53
	696.86	698.47	700.79	702.1	703.42	704.74	706.05	707.37	708.68
FLO	0.00	315.21	1543.46	4111.47	8022.76	13975.29	25051.13	35713.49	47865.05
	76356.67	92591.11	110107.9	128087.3	146822.7	165964.66	192250.75	215765.19	240168.91

MAXIMUM STAGE IS 688.5

MAXIMUM STAGE IS 689.7

MAXIMUM STAGE IS 690.2

MAXIMUM STAGE IS 690.6

MAXIMUM STAGE IS 691.2

MAXIMUM STAGE IS 691.8

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 4 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	0	0	2	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	17.37	0.00	152.10	0.87	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	15.56	93.00	97.00	1 5.00	1 0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00	2.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 6.73 R= 5.73 NTA= 0

RECESSION DATA

STRTQ= 34.[illegible] QRCSN= 34.[illegible] RTIOR= 1.00

UNIT HYDROGRAPH 51 END-OF-PERIOD ORDINATES, LAG= 7.98 HOURS, CP= 0.57 VOL= 1.00

53.	124.	250.	395.	547.	678.	768.	815.	802.	736.
656.	565.	522.	465.	415.	370.	330.	294.	262.	234.
208.	186.	166.	148.	132.	117.	105.	93.	83.	74.
66.	59.	53.	47.	42.	37.	33.	30.	26.	24.
21.	19.	17.	15.	13.	12.	11.	9.	8.	7.
6.									

0

END-OF-PERIOD FLOW

A .DA	HR..	PERIOD	RAIN	EXCS	LOSS	C MI.	AC.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 19.46 15.70 3.76 178062.
(494.)(399.)(95.)(5042.15)

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 5 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	C	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	C	19.65	C.CC	152.1C	0.CC	C.000	0	1	C

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
C.C•	1[illegible]	[illegible]	[illegible]	1[illegible]	1[illegible]	C.CC	C.CC

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
[illegible]	C.CC	C.CC	1.0[illegible]	C.CC	[illegible]	1.CC	1.CC	C.1C	C.CC	C.CC

UNIT HYDROGRAPH DATA

TC= 10.10 R= 10.10 NTA= C

RECESSION DATA

STRTQ= 4[illegible] GRCSN= 4[illegible] RTIOR= 1.CC

UNIT HYDROGRAPH 5% END-OF-PERIOD ORDINATES, LAG= 9.22 HOURS, CP= 0.57 VOL= 1.CC

[illegible]6.	98.	2[illegible].	317.	445.	571.	677.	752.	794.	798.
754.	685.	619.	56[illegible].	5[illegible].	46[illegible].	416.	377.	341.	309.
2[illegible].	254.	23[illegible].	2[illegible].	1[illegible].	171.	155.	140.	127.	115.
1[illegible].	94.	[illegible].	77.	7[illegible].	63.	57.	52.	47.	43.
39.	35.	32.	29.	26.	24.	21.	19.	17.	16.
14.	13.	1[illegible].	11.	1[illegible].	9.	8.	7.	6.	

G

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP G	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP G

SUM 19.46 15.7C 3.76 200619.
(494.)(399.)(95.)(5680.89)

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COMBINE HYDROGRAPHS

COMBINE 5 HYDROGRAPHS AT 5

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	3	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE TO AREA 7

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

FN(1)	FN(2)	FN(3)	ELNVT	ELMAX	FLOTH	SEL
[illegible]	[illegible]	[illegible]	695.0	720.0	[illegible]	[illegible]

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

100.00 720.00 150.00 710.00 375.00 700.00 450.00 685.00 500.00 685.00
1000.00 720.00 1500.00 710.00 1550.00 720.00

STORAGE	0.00	16.64	51.[illegible]	99.9[illegible]	161.75	239.48	332.17	439.79	562.33
	675.19	1073.85	1300.79	1555.98	1837.14	2126.20	2419.15	2715.99	3016.73
OUTFLOW	0.00	311.89	1296.71	3170.43	6136.61	10362.39	16082.39	23401.45	32496.41
	61577.06	79793.09	100527.62	123961.89	150425.88	180197.00	212556.34	247408.47	284678.25
STAGE	695.00	696.84	698.69	699.53	699.37	699.21	699.05	697.89	699.74
	703.42	705.24	707.10	708.95	710.79	712.63	714.47	716.31	718.16
FLOW	0.0	311.89	1296.71	3170.43	6136.61	10362.39	16082.39	23401.45	32496.41
	61577.06	79793.09	100527.62	123961.89	150425.88	180197.00	212556.34	247408.47	284678.25

MAXIMUM STAGE IS [illegible]

MAXIMUM STAGE IS 695.7

MAXIMUM STAGE IS 696.7

MAXIMUM STAGE IS [illegible]

MAXIMUM STAGE IS 699.4

MAXIMUM STAGE IS 700.7

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 6 RUNOFF

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	0	0	0	5	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	3.16	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	16.50	85.00	97.00	105.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.677

LOSS DATA

ERAIN	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 0.14 R= 0.14 NTA= 0

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 36 END-OF-PERIOD ORDINATES, LAG= 5.51 HOURS, CP= 0.57 VOL= 1.00

14.	56.	104.	157.	195.	210.	196.	167.	142.	120.
102.	87.	74.	63.	53.	45.	38.	33.	28.	24.
20.	17.	14.	12.	10.	9.	8.	6.	5.	5.
4.	3.	3.	2.	2.	2.				

C

END-OF-PERIOD FLOW

M	DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	PO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
										SUM	19.46	15.70	3.76	32390.
											(494.)(399.)(95.)(917.18)			

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COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT 4

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO

4	2	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE THRU AREA 2

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICOTO
5	1	0	0	0	0	1	0	0

ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IEMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

S (1)	AN(2)	AN(3)	ELMVT	ELMAX	RLNTH	SEL
0.0000	0.0400	0.0800	595.0	620.0	45000.	0.00200

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

	[illegible]	595.00	615.00	45000.00	[illegible]	595.00	615.00	595.00	
	620.00	650.00	650.00	615.00	15000.00	620.00			
STORAGE	0.00	141.64	307.00	497.20	711.02	953.33	1226.35	1530.22	1864.80
	2620.23	3053.09	3522.04	4029.07	4731.72	5477.54	6317.33	7251.10	8278.86
OUTFLOW	.00	271.95	896.42	1853.44	3126.81	4924.60	7077.90	9690.19	12466.04
	19331.43	23334.71	27594.00	32345.17	37663.59	43579.75	50135.80	57274.62	65337.88
STAGE	595.00	596.31	597.63	598.95	600.26	601.58	602.89	604.21	605.53
	606.86	608.19	609.52	610.85	612.18	613.52	614.86	616.20	617.54
FLOW	.00	271.95	896.42	1853.44	3126.81	4924.60	7077.90	9690.19	12466.04
	19331.43	23334.71	27594.00	32345.17	37663.59	43579.75	50135.80	57274.62	65337.88

MAXIMUM STAGE IS 605.5

MAXIMUM STAGE IS 606.8

MAXIMUM STAGE IS 608.1

MAXIMUM STAGE IS 609.4

MAXIMUM STAGE IS 611.0

MAXIMUM STAGE IS 613.7

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 7 RUNOFF

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	17.65	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	85.00	97.00	105.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.677

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.0

UNIT HYDROGRAPH DATA

TC= 0.55 R= 0.55 TIA= 0

RECESSION DATA

STRTQ= 34.00 QRCSN= 34.00 RTIOR= 1.00

UNIT HYDROGRAPH 55 END-OF-PERIOD ORDINATES, LAG= 7.20 HOURS, CP= 0.57 VOL= 1.00

34.	126.	256.	407.	561.	692.	779.	819.	795.	721.
641.	570.	507.	451.	401.	357.	318.	283.	251.	224.
199.	177.	157.	140.	124.	111.	98.	88.	78.	69.
62.	55.	49.	43.	39.	34.	31.	27.	24.	21.
19.	17.	15.	13.	12.	11.	9.	8.	7.	7.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.40	15.71	3.70	174869.
										(494.)(399.)(95.)(4951.73)			

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 9 RUNOFF

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
9	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	[illegible]	0.00	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	85.00	97.00	105.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LKOPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
[illegible]	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 6.54 R= 6.54 NTA= 0

RECESSION DATA

STRTQ= 12.00 QRCSN= 12.00 RTIOR= 1.00

UNIT HYDROGRAPH 59 END-OF-PERIOD ORDINATES, LAG= 5.91 HOURS, CP= 0.57 VOL= 1.00

65.	86.	171.	262.	334.	372.	363.	321.	275.	236.
203.	174.	149.	128.	110.	94.	81.	69.	59.	51.
44.	38.	32.	28.	24.	20.	17.	15.	13.	11.
9.	8.	7.	6.	5.	4.	4.	3.	3.	

C

END-OF-PERIOD FLOW

N..DA	HR.MN	PERIOD	RAI	EXCS	LOSS	COMP Q	NO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									Sum	19.46	15.70	3.76	61564.
										(494.)(399.)(95.)(1743.3C)			

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COMBINE HYDROGRAPHS

COMBINE 3 HYDROGRAPHS AT 5

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	3	0	0	0	0	1	C	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE TOTAL AREA =

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	1	0	0	0	0	1	C	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	C

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0800	0.0400	0.0800	565.0	600.0	44750.	0.0007

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
100.00 600.00 200.00 590.00 350.00 580.00 500.00 565.00 700.00 565.00
800.00 580.00 850.00 590.00 900.00 600.00

STORAGE	0.00	407.52	873.14	1396.85	1978.66	2618.57	3316.58	4072.68	4886.88
	6709.60	7725.47	8811.06	9966.37	11189.79	12480.36	13799.21	15182.34	16617.77
OUTFLOW	0.00	560.74	1836.22	3730.04	6232.67	9355.65	13119.19	17547.56	22667.09
	37141.91	45640.11	54939.71	65048.55	75992.66	87774.97	100367.95	113772.08	127989.44
STAGE	565.00	566.84	568.68	570.53	572.37	574.21	576.05	577.89	579.74
	583.42	585.26	587.10	588.95	590.79	592.63	594.47	596.31	598.16
FLOW	0.00	560.74	1836.22	3730.04	6232.67	9355.65	13119.19	17547.56	22667.09
	37141.91	45640.11	54939.71	65048.55	75992.66	87774.97	100367.95	113772.08	127989.44

MAXIMUM STAGE IS 573.9

MAXIMUM STAGE IS 576.4

MAXIMUM STAGE IS 580.1

MAXIMUM STAGE IS 581.6

MAXIMUM STAGE IS 584.0

MAXIMUM STAGE IS 586.2

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SUB-AREA RUNOFF COMPUTATION

SUB AREA & RUNOFF

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
8	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	11.70	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	85.00	97.00	105.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 8.77 R= 8.77 NTA= 0

RECESSION DATA

STRTQ= 24.00 QRCSN= 24.00 RTIOR= 1.00

UNIT HYDROGRAPH 52 END-OF-PERIOD ORDINATES, LAG= 8.01 HOURS, CP= 0.57 VOL= 1.00

22.	82.	167.	263.	364.	453.	514.	546.	539.	496.
442.	395.	352.	314.	280.	250.	223.	199.	177.	158.
141.	126.	112.	100.	89.	80.	71.	64.	57.	51.
45.	40.	36.	32.	29.	25.	23.	20.	18.	16.
14.	13.	11.	10.	9.	8.	7.	6.	6.	5.
5.	4.								

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	120650.
										(494.)	(399.)	(95.)	(3399.43)

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 10 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	13.90	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	85.00	97.00	105.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 15.12 R= 15.12 NIA= 0

RECESSION DATA
STRTQ= 28.00 QRCSN= 28.00 RTIOR= 1.00

UNIT HYDROGRAPH 77 END-OF-PERIOD ORDINATES, LAG= 12.21 HOURS, CP= 0.58 VOL= 1.00

16.	37.	75.	120.	170.	223.	278.	329.	372.	404.
426.	437.	435.	414.	384.	356.	330.	306.	283.	263.
243.	225.	209.	194.	179.	166.	154.	143.	132.	122.
113.	105.	97.	90.	84.	77.	72.	67.	62.	57.
53.	49.	45.	42.	39.	36.	33.	31.	29.	27.
25.	23.	21.	20.	18.	17.	16.	14.	13.	12.
12.	11.	10.	9.	8.	8.	7.	7.	6.	6.
5.	5.	5.	4.	4.	4.	3.			

0
END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	138862.
										(494.)	(399.)	(95.)	(3932.13)

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COMBINE HYDROGRAPHS

COMBINE 3 HYDROGRAPHS AT 6

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	3	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE THRU AREA 11

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QK(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0800	0.0400	0.0800	514.0	530.0	14000.	0.0040

CROSS SECTION COORDINATES--STA/ELEV/STA/ELEV--ETC

100.00 530.00 250.00 525.00 400.00 520.00 525.00 514.00 600.00 514.00
900.00 520.00 1000.00 525.00 1100.00 530.00

STORAGE	0.00	28.37	72.88	133.56	210.32	303.25	412.33	537.55	677.09
	993.43	1164.20	1349.35	1545.97	1753.85	1973.19	2203.92	2446.05	2699.57
OUTFLOW	0.00	156.90	592.05	1356.75	2517.03	4124.25	6234.65	8899.94	12813.69
	22692.66	28562.35	35052.50	42165.38	49904.41	58274.00	67279.36	76926.19	87220.77
STAGE	514.00	514.84	515.68	516.53	517.37	518.21	519.05	519.89	520.74
	522.42	523.26	524.10	524.95	525.79	526.63	527.47	528.31	529.16
FLOW	0.00	156.90	592.05	1356.75	2517.03	4124.25	6234.65	8899.94	12813.69
	22692.66	28562.35	35052.50	42165.38	49904.41	58274.00	67279.36	76926.19	87220.77

MAXIMUM STAGE IS 526.4

MAXIMUM STAGE IS 522.5

MAXIMUM STAGE IS 523.4

MAXIMUM STAGE IS 524.3

MAXIMUM STAGE IS 525.7

MAXIMUM STAGE IS 527.0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

SUB AREA 11 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	4.05	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	13.50	25.00	97.00	15.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	1.00	1.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 2.70 R= 2.70 MTA= 0

RECESSION DATA

STRTQ= 8.CC QRCSN= 6.00 RTIOR= 1.00

UNIT HYDROGRAPH 16 END-OF-PERIOD ORDINATES, LAG= 2.58 HOURS, CP= 0.58 VOL= 1.CC

124. 404. 557. 468. 325. 225. 156. 108. 75. 52.
36. 25. 17. 12. 8. 6.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	41534.
										(494.)	(399.)	(95.)	(1176.11)

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT 7

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	2	0	0	0	0	1	C	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE OVER DAM NO 2 (VIC ANTWERP)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
C.0	0.CCO	C.CC	1	1	0	0	C

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.CCC	C.CCO	C.CCO	-514.	C

CAPACITY=	C.	1c.	3c.	7c.	140.	242.	61C.	1120.
ELEVATION=	505.	51C.	514.	516.	51c.	52C.	525.	53C.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
514.0	142.0	3.2	1.5	C.0	0.C	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMAID
515.0	2.6	1.5	1000.

PEAK OUTFLOW IS 11164. AT TIME 5c.0c HOURS

PEAK OUTFLOW IS 25000. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 38096. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 36715. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 46870. AT TIME 50.00 HOURS

PEAK OUTFLOW IS 62799. AT TIME 50.00 HOURS

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 12 RUNOFF

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
12	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	1.03	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	85.00	97.00	105.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 1.13 R= 1.10 NTA= 0

RECESSION DATA

STRTQ= 2.00 QRCSN= 2.00 RTIOR= 1.00

UNIT HYDROGRAPH 7 END-OF-PERIOD ORDINATES, LAG= 1.07 HOURS, CP= 0.53 VOL= 1.00

193. 272. 119. 46. 18. 7. 3.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
		SUM	19.46	15.70	3.76	10584.
			(494.)	(399.)	(95.)	(299.71)

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COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT 8

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
8	2	0	0	0	0	1	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE OVER DAM AT ANTWERP

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
8	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-490.	-1

STAGE	490.30	493.00	495.00	497.00	500.00	502.00	503.50	505.00	510.00
FLOW	0.00	700.00	1900.00	3500.00	6550.00	8000.00	10000.00	13000.00	32000.00
CAPACITY=	0.	90.	175.	265.	420.	560.	660.	765.	1250.	2470.
ELEVATION=	490.	493.	495.	497.	500.	502.	504.	505.	510.	518.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
490.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
491.1	2.6	1.5	0.

PEAK OUTFLOW IS 11136. AT TIME 52.00 HOURS

PEAK OUTFLOW IS 25588. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 31038. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 36729. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 49797. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 62663. AT TIME 51.00 HOURS

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS					
				RATIO 1 0.20	RATIO 2 0.40	RATIO 3 0.50	RATIO 4 0.60	RATIO 5 0.80	RATIO 6 1.00
HYDROGRAPH AT	1	3.02	1	301.	602.	753.	904.	1205.	1506.
		(7.82)		(8.53)(	17.06)(	21.32)(	25.59)(	34.12)(	42.65)(
ROUTED TO	2	3.02	1	220.	472.	599.	730.	968.	1193.
		(7.82)		(6.22)(	13.37)(	16.96)(	20.68)(	27.42)(	33.78)(
HYDROGRAPH AT	1	18.11	1	2450.	4900.	6125.	7351.	9801.	12251.
		(46.90)		(69.38)(	138.76)(	173.45)(	208.14)(	277.52)(	346.90)(
HYDROGRAPH AT	3	11.63	1	1230.	2460.	3076.	3691.	4921.	6151.
		(30.12)		(34.84)(	69.67)(	87.09)(	104.51)(	139.34)(	174.18)(
3 COMBINED	4	32.76	1	3705.	7456.	9325.	11204.	14965.	18734.
		(84.85)		(104.91)(	210.95)(	264.04)(	317.26)(	423.75)(	530.48)(
ROUTED TO	5	32.76	1	3153.	6620.	8331.	10345.	14049.	17759.
		(84.85)		(89.29)(	187.47)(	235.90)(	292.95)(	397.83)(	502.87)(
HYDROGRAPH AT	4	17.37	1	2170.	4340.	5424.	6509.	8679.	10849.
		(44.99)		(61.44)(	122.88)(	153.60)(	184.33)(	245.77)(	307.21)(
HYDROGRAPH AT	5	19.65	1	2173.	4346.	5433.	6519.	8692.	10865.
		(50.89)		(61.53)(	123.07)(	153.83)(	184.60)(	246.13)(	307.66)(
3 COMBINED	6	69.78	1	7226.	14933.	18771.	22929.	31028.	39133.
		(180.73)		(204.63)(	422.90)(	531.54)(	649.29)(	878.62)(	1108.11)(
ROUTED TO	6	69.78	1	7245.	14914.	18722.	22859.	30954.	39082.
		(180.73)		(205.16)(	422.52)(	530.14)(	646.72)(	876.52)(	1106.69)(
HYDROGRAPH AT	8	5.16	1	523.	1045.	1306.	1568.	2090.	2613.
		(8.18)		(14.80)(	29.59)(	36.99)(	44.39)(	59.19)(	73.98)(
2 COMBINED	9	72.94	1	7573.	15632.	19655.	23972.	32488.	41000.
		(188.91)		(214.44)(	442.65)(	556.58)(	678.80)(	919.97)(	1161.00)(
ROUTED TO	9	72.94	1	7295.	15130.	19039.	23181.	31186.	39106.
		(188.91)		(206.56)(	428.42)(	539.16)(	656.41)(	883.10)(	1107.57)(

HYDROGRAPH AT	7	17.05	1	2166.	4333.	5416.	6499.	8666.	10832.
	(	44.16)	(	61.35)(	122.70)(	153.37)(	184.04)(	245.39)(	306.74)(
HYDROGRAPH AT	9	6.00	1	942.	1885.	2356.	2827.	3769.	4712.
	(	15.53)	(	26.68)(	53.37)(	66.71)(	80.05)(	106.73)(	133.42)(
3 COMBINED	5	95.99	1	9717.	20127.	25355.	30799.	41452.	51994.
	(	248.81)	(	275.14)(	569.92)(	717.96)(	872.12)(	1173.79)(	1472.29)(
ROUTED TO	6	95.99	1	8878.	18869.	24015.	29337.	39888.	50256.
	(	248.81)	(	251.40)(	534.32)(	680.02)(	830.72)(	1129.51)(	1423.10)(
HYDROGRAPH AT	8	11.70	1	1456.	2912.	3640.	4368.	5824.	7281.
	(	30.30)	(	41.23)(	82.46)(	103.08)(	123.70)(	164.93)(	206.16)(
HYDROGRAPH AT	10	13.90	1	1228.	2455.	3069.	3683.	4910.	6138.
	(	36.00)	(	34.76)(	69.52)(	86.90)(	104.28)(	139.04)(	173.80)(
3 COMBINED	4	121.59	1	11117.	23511.	29844.	36562.	49630.	62434.
	(	314.91)	(	314.80)(	665.74)(	845.09)(	1035.32)(	1405.37)(	1767.93)(
ROUTED TO	7	121.59	1	11094.	23509.	29884.	36448.	49466.	62315.
	(	314.91)	(	314.15)(	665.69)(	846.22)(	1032.08)(	1400.72)(	1764.56)(
HYDROGRAPH AT	11	4.05	1	1120.	2241.	2801.	3361.	4482.	5602.
	(	10.49)	(	31.73)(	63.45)(	79.32)(	95.18)(	126.91)(	158.63)(
2 COMBINED	2	125.64	1	11147.	23661.	30075.	36676.	49901.	62859.
	(	325.40)	(	315.65)(	670.01)(	851.62)(	1038.56)(	1413.04)(	1779.96)(
ROUTED TO	3	125.64	1	11164.	23666.	30096.	36713.	49876.	62799.
	(	325.40)	(	316.12)(	670.20)(	852.22)(	1039.60)(	1412.32)(	1778.26)(
HYDROGRAPH AT	12	1.65	1	423.	845.	1057.	1268.	1691.	2113.
	(	2.87)	(	11.97)(	23.94)(	29.92)(	35.91)(	47.88)(	59.85)(
2 COMBINED	2	126.67	1	11164.	23670.	30098.	36716.	49882.	62806.
	(	328.07)	(	316.13)(	670.24)(	852.28)(	1039.68)(	1412.49)(	1778.48)(
ROUTED TO	1	126.67	1	11136.	23588.	30038.	36729.	49797.	62613.
	(	328.07)	(	315.34)(	667.93)(	850.57)(	1040.05)(	1410.11)(	1772.72)(

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	220.	826.6	55.00
0.40	472.	828.7	54.00
0.50	599.	829.5	53.00

0.60	730.	830.2	53.00
0.80	968.	831.2	53.00
1.00	1195.	831.9	54.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	3153.	688.5	50.00
0.40	6620.	689.7	50.00
0.50	8331.	690.2	50.00
0.60	10345.	690.6	49.00
0.80	14049.	691.2	49.00
1.00	17759.	691.8	49.00

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7245.	692.8	49.00
0.40	14914.	695.7	49.00
0.50	18722.	696.7	49.00
0.60	22839.	697.8	49.00
0.80	30954.	699.4	48.00
1.00	39182.	700.7	48.00

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7245.	603.0	50.00
0.40	15130.	606.6	50.00
0.50	19039.	608.1	50.00
0.60	23181.	609.4	50.00
0.80	31106.	611.8	50.00
1.00	39106.	613.7	50.00

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	8078.	573.9	52.00
0.40	18869.	578.4	51.00
0.50	24115.	580.1	51.00
0.60	29337.	581.6	51.00
0.80	39108.	584.0	50.00
1.00	50256.	586.2	50.00

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
[illegible]	11[illegible]94.	52[illegible].4	52.00
0.40	23[illegible]9.	522.5	51.00
0.50	29[illegible]4.	523.4	51.00
0.60	36448.	524.3	51.00
[illegible].8[illegible]	494[illegible].	525.7	50.00
1.00	62315.	527.0	50.00

SUMMARY OF DAM SAFETY ANALYSIS

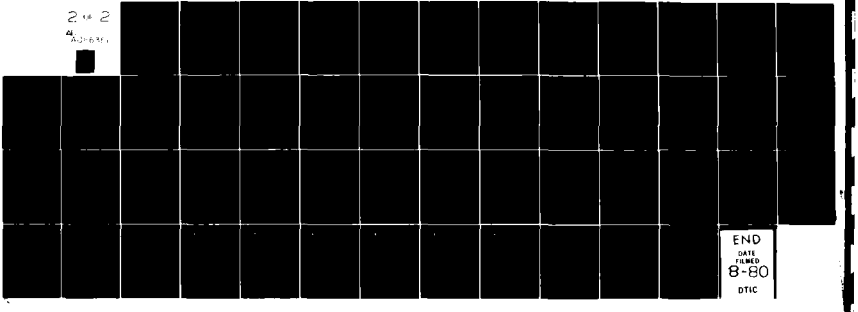
PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	514.00	514.00	515.00
STORAGE	36.	36.	53.
OUTFLOW	0.	0.	454.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.40	518.73	3.73	177.	23668.	69.00	51.00	0.00
0.50	519.40	4.40	216.	30096.	72.00	51.00	0.00
0.60	520.05	5.05	246.	36713.	73.00	51.00	0.00
0.80	521.23	6.23	332.	49876.	73.00	50.00	0.00
1.00	522.29	7.29	410.	62799.	74.00	50.00	0.00

AD-A086 351 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. DAM NUMBER 2. INVENTORY NUMBER NY --ETC(U)
FEB 80 J B STETSON DACW-51-79-C-0001

UNCLASSIFIED NL



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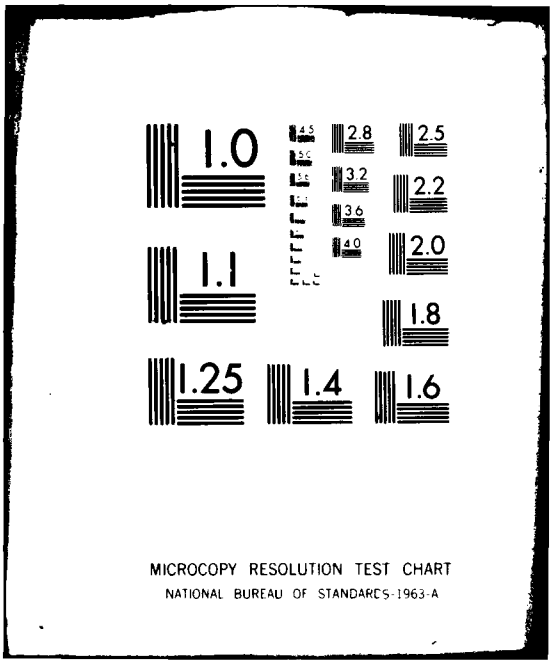
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	490.30	490.30	491.10
STORAGE	0.	0.	27.
OUTFLOW	0.	0.	207.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	504.06	12.96	699.	11136.	68.00	52.00	0.00
0.40	507.78	16.68	1035.	23588.	73.00	51.00	0.00
0.50	509.48	18.38	1199.	30038.	74.00	51.00	0.00
0.60	510.99	19.89	1401.	36729.	74.00	51.00	0.00
0.80	513.74	22.64	1820.	49797.	75.00	51.00	0.00
1.00	516.44	25.34	2251.	62603.	88.00	51.00	0.00

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(0001)   A1 DAM NO 2  (ANTWERP)
(0002)   A2 HEC-1DB
(0003)   A3 PMF-DAM BREAK ANALYSIS
(0004)   B      90         1         0         0         0         0         0         0         4
(0005)   B1      5
(0006)   J       3         6         1
(0007)   J1    .2        .4        .5        .6        .8       1.0
(0008)   K       0         1         0         0         0         0         1
(0009)   K1   SUB AREA 1 RUNOFF    CLARK'S PARAMETERS
(0010)   M       1         0      3.02         0     152.1         0         0         0         1
(0011)   P       0      18.5        85        97       105       120
(0012)   T       0         0         0         0         0         0         1       0.1
(0013)   V   11.39     11.39
(0014)   X       0         0         1
(0015)   K       1         2         0         0         0         0         1
(0016)   K1   CHANNEL ROUTE THRU AREA 2
(0017)   Y       0         0         0         1         1
(0018)   Y1      1         0         0         0         0         0        -1
(0019)   Y6    .08       .04       .08       822       850     40500     .0003
(0020)   Y7    100       850       300       840       580       850       400       822       420       822
(0021)   Y7    450       830       875       840      1000       850
(0022)   K       0         1         0         0         0         0         1
(0023)   K1   SUB AREA 2 RUNOFF
(0024)   M       1         0     18.11         0     152.1         0         0         0         1
(0025)   P       0      18.5        85        97       102       120
(0026)   T       0         0         0         0         0         0         1       0.1
(0027)   V    7.88      7.88
(0028)   A      36        36         1
(0029)   K       0         3         0         0         0         0         1
(0030)   K1 SUB AREA 3 RUNOFF
(0031)   M       1         0     11.65         0     152.1         0         0         0         1
(0032)   P       0      18.5        85        97       105       120
(0033)   T       0         0         0         0         0         0         1       0.1
(0034)   V   10.62     10.62
(0035)   X      24        24         1
(0036)   K       3         2         0         0         0         0         1
(0037)   K1   COMBINE 3 HYDROGRAPHS AT 2
(0038)   K       1         3         0         0         0         0         1
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(0039)   K1  CHANNEL ROUTE THRU AREA 4
(0040)   Y       0       0       0       1       1
(0041)   Y1      1       0       1       0       0       0      -1
(0042)   Y6    .04     .04     .04     685     710   46000    .003
(0043)   Y7    100     710     150     700     150     670     475     685     525     685
(0044)   Y7    850     690     900     700     925     710
(0045)   K       0       4       0       0       0       0       1
(0046)   K1  SUB AREA 4 RUNOFF
(0047)   A       1       0   17.37       0   152.1       0       0       0       1
(0048)   B       0    18.5      85      97     105     120
(0049)   T       0       0       0       0       0       0       1     0.1
(0050)   V    0.73    0.73
(0051)   X      34      34       1
(0052)   K       0       5       0       0       0       0       1
(0053)   K1  SUB AREA 5 RUNOFF
(0054)   A       1       0   19.45       0   152.1       0       0       0       1
(0055)   B       0    18.5      85      97     105     120
(0056)   T       0       0       0       0       0       0       1     0.1
(0057)   V   18.18   18.18
(0058)   X      40      40       1
(0059)   K       0       3       0       0       0       0       1
(0060)   K1  COMBINE 3 HYDROGRAPHS AT 3
(0061)   K       1       4       0       0       0       0       1
(0062)   K1  CHANNEL ROUTE TO   AREA 7
(0063)   Y       0       0       0       1       1
(0064)   Y1      1       0       1       0       0       0      -1
(0065)   Y6    .04     .04     .04     685     720   52000    .002
(0067)   Y7    120     720     150     710     375     710     450     685     500     685
(0067)   Y7   1000     700    1500     710    1550     720
(0068)   K       0       6       0       0       0       0       1
(0069)   K1  SUB AREA 6 RUNOFF
(0070)   A       1       0    3.16       0   152.1       0       0       0       1
(0071)   B       0    18.5      85      97     105     120
(0072)   T       0       0       0       0       0       0       1     0.1
(0073)   V    0.14    0.14
(0074)   X      46      46       1
(0075)   K       0       4       0       0       0       0       1
(0076)   K1  COMBINE 2 HYDROGRAPHS AT 4
```

```
(0077)   K        1        5        0        1        0        0        1
(0078)   K1 CHANNEL ROUTE THRU AREA 1
(0079)   Y        0        0        1        1        1
(0080)   Y1       1        0        0        0        0        0       -1
(0081)   Y0     .05      .04      .05      595      626   43560.0     .002
(0082)   Y7     1.0      0.0      5.0      0.0      45.0     0.0      5.0      595      626      595
(0083)   Y7     426      0.0     60.0      0.0     101.0     0.0
(0084)   K        0        7        0        0        0        0        1
(0085)   K1 SUB AREA 7 RUNOFF
(0086)   A        1             17.2                154.1                      0        0        1
(0087)   F                 1.0.5        5       97      185      12.
(0088)   T                  0.1      0.1      0.1      0.1      0.1        1      0.1
(0089)   V    0.55     0.55
(0090)   A      54       54        1
(0091)   K                  9        1        0        0        0        1
(0092)   K1 SUB AREA 9 RUNOFF
(0093)   A        1        9     5.996       0.0     154.1        0        0        0        1
(0094)   F                18.5        5       97      185      12.
(0095)   T                  0.1      0.1      0.1      0.1      0.1        1      0.1
(0096)   V    0.54     0.54
(0097)   A       12       12        1
(0098)   F                  9                 0.0                           1
(0099)   K1 CONSERVE 3 FOR SUBAREA 15 AT 9
(0100)   K        1        6        1        0        0        0        1
(0101)   K1 CHANNEL ROUTE THRU AREA 6
(0102)   Y        0        0        1        1        1
(0103)   Y1       1        0        0        0        0        0       -1
(0104)   Y6     .05      .04      .05      565      600   44730.0   .00007
(0105)   Y7     1.0      6.0      2.0      5.0      55.0     5.0      5.0      565      600      565
(0106)   Y7     0.0     50.0     80.0     50.0     90.0     0.0
(0107)   K        0        6        0        0        0        0        1
(0108)   K1 SUB AREA 6 RUNOFF
(0109)   A        1        6     11.7        0.0     154.1        0        0        0        1
(0110)   F                18.2        5       97      185      12.
(0111)   T                  0.1      0.1      0.1      0.1      0.1        1      0.1
(0112)   V    .07      .07
(0113)   A      24       24        1
(0114)   K                 10                 0.0                           1
```

```
(0115)   K1  SUB AREA 10 RUNOFF
(0116)   K       1       0     13.5        0   152.1        0        0        0        1
(0117)   F       0    16.5       .5       97     105      120
(0118)   T       0       0        0        0       0        0        1      0.1
(0119)   V   13.12   13.12
(0120)   X      28       28       1
(0121)   K       3        6       0        0       0        0        1
(0122)   K1  COMBINE 3 HYDROGRAPHS AT 6
(0123)   K       1        7       0        0       0        0        1
(0124)   K1  CHANNEL ROUTE THRU AREA 11
(0125)   Y       0        0       0        1       1
(0126)   Y1      1        0       0        0       0        0       -1
(0127)   Y6    .04      .04     .04      514     530    14000     .004
(0128)   Y7    100      530     250      525     400      520      525      514      600      514
(0129)   Y7    900      520    1000      525    1100      530
(0130)   K       6       11       0        0       0        0        1
(0131)   K1  SUB AREA 11 RUNOFF
(0132)   K       1        0    4.05        0   152.1        0        0        0        1
(0133)   F       0    18.5       .5       97     105      120
(0134)   T       0       0        0        0       0        1      0.1
(0135)   V    2.76     2.76
(0136)   X       5        5       1
(0137)   K       4        7       5        0       0        0        1
(0138)   K1  COMBINE 4 HYDROGRAPHS AT 7
(0139)   K       1        7       0        0       0        0        1
(0140)   K1  ROUTE THRU DAM NO 2 (VIC ANTWERP)
(0141)   Y       0        0       0        1       1
(0142)   Y1      1        0       0        0       0        0     -514
(0143)   $S      0       10      50       70     140      242      610     1120
(0144)   $E  505.4      510     514      516     518      520      525      530
(0145)   $$    514      142     3.2      1.5
(0146)   $D    515     2.04     1.5     1000
(0147)   $B     7        1   505.4        1     514      516
(0148)   $B    14        1   505.4        1     514      516
(0149)   $B     4        1   505.4        1     514      516
(0150)   K       0       16       0        0       0        0        1
(0151)   K1  SUB AREA 12 RUNOFF
(0152)   K       1        0    1.03        0   152.1        0        0        0        1
```

```
(0153)  P       0     16.5      65      97     105     120
(0154)  T       0        0       0       0       0       0       1     0.1
(0155)  V    1.13     1.13
(0156)  X       2        2       1
(0157)  K       2        8       0       0       0       0       1
(0158)  K1   COMBINE 2 HYDROGRAPHS AT 8
(0159)  K       1        2       0       0       0       0       1
(0160)  K1      ROUTE OVER DAM AT ANTWERP
(0161)  Y       0        0       0       1       1
(0162)  Y1      1                                        -490.5      -1
(0163)  Y4  490.5      493     495     497     500     502   503.5     505     510     518
(0164)  Y5      0      700    1900    3500    6550    8000   10000   13000   32000   70000
(0165)  SS      0       95     175     265     420     560     660     765    1250    2470
(0166)  SE  490.5      493     495     497     500     502   503.5     505     510     518
(0167)  SS  490.5
(0168)  SD  491.1     2.04     1.5     0.1
(0169)  K      99
(0170)  A
(0171)  A
(0172)  A
(0173)  A
(0174)  A
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
RUNOFF HYDROGRAPH AT	1
RUNOFF HYDROGRAPH AT	3
COMBINE 3 HYDROGRAPHS AT	2
ROUTE HYDROGRAPH TO	3
RUNOFF HYDROGRAPH AT	4
RUNOFF HYDROGRAPH AT	5
COMBINE 3 HYDROGRAPHS AT	3
ROUTE HYDROGRAPH TO	4
RUNOFF HYDROGRAPH AT	6
COMBINE 2 HYDROGRAPHS AT	4
ROUTE HYDROGRAPH TO	5
RUNOFF HYDROGRAPH AT	7
RUNOFF HYDROGRAPH AT	9
COMBINE 3 HYDROGRAPHS AT	5
ROUTE HYDROGRAPH TO	6
RUNOFF HYDROGRAPH AT	8
RUNOFF HYDROGRAPH AT	10
COMBINE 3 HYDROGRAPHS AT	6
ROUTE HYDROGRAPH TO	7
RUNOFF HYDROGRAPH AT	11
COMBINE 2 HYDROGRAPHS AT	7
ROUTE HYDROGRAPH TO	7
RUNOFF HYDROGRAPH AT	12
COMBINE 2 HYDROGRAPHS AT	8
ROUTE HYDROGRAPH TO	8

END OF NETWORK

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN  DATE?%ED. NOV 14 1979
     TIME?15:26:24

                    DAM NO 2  (ANT%ERP)
                    HEC-1DB
                    PMF-DAM BREAK ANALYSIS

                                JOB SPECIFICATION
     NQ      NPR      NMIN      IDAY      IHR      IMIN     METRC      IPLT      IPRT     NSTAN
     9(         1         (         (         (         (         (         4         (
                         JOPER       NWT     LROPT     TRACE
                             5         0         (         (

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                                NPLAN= 1  NRTIO= 6  LRTIO= 1
                RTIOS=    0.20    0.40    0.50    0.80    0.90    1.00

**********          **********          **********          **********          **********

                          SUB-AREA RUNOFF COMPUTATION

               SUB AREA 1 NUMBER    CLARK'S PARAMETERS
                             ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    ICLTO
                                 1        0        0        0        0        0        1        0        0

                                HYDROGRAPH DATA
                    IHYDG      IUNG      TAREA      SNAP      TRSDA      TRSPC     RATIO     ISNOW     ISAME     LOCAL
                        1         1       3.02      0.00    152.10       0.00    0.000         0         1         0

                                PRECIP DATA
                              SPFE       PMS        R6        R12       R24       R48       R72       R96
                              0.00     18.50     75.00     87.00    105.00    120.00      0.00      0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.877

                                LOSS DATA
               LROPT     STRKR     DLTKR     RTIOL     ERAIN     STRKS     RTIOR     STRTL     CNSTL     ALSMX     RTIMP
                   0      0.00      0.00      1.00      0.00      0.00      1.00      1.00      0.10      0.00      0.00

                                UNIT HYDROGRAPH DATA
                             TC=  11.59     R=  11.59     TA=  0
```

RECESSION DATA
STRTQ= 6.CC QRCSN= 6.00 RTIOR= 1.00

UNIT HYDROGRAPH 67 END-OF-PERIOD ORDINATES, LAG= 10.38 HOURS, CP= 0.57 VOL= 1.CC

3.	11.	23.	37.	52.	67.	82.	94.	103.	108.
109.	105.	97.	89.	81.	75.	68.	63.	57.	52.
48.	44.	40.	37.	34.	31.	28.	26.	24.	22.
20.	18.	17.	15.	14.	13.	12.	11.	10.	9.
8.	8.	7.	6.	6.	5.	5.	4.	4.	4.
3.	3.	3.	3.	2.	2.	2.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.			

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	30587.
										(494.)(	399.)(	95.)(	866.13)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

CHANNEL ROUTE THRU AREA 6

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	3	1	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	3	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QQ(1)	QN(2)	QN(3)	ELMVT	ELMAX	RLNTH	SEL
0.0800	0.0400	0.0800	822.0	850.0	40500.	0.0050

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
1F0.00 850.00 300.00 840.00 3[illegible].00 850.00 4[illegible].00 822.00 420.00 822.00
450.00 850.00 875.00 840.00 1000.00 850.00

STORAGE	[illegible]	33.71	80.04	138.99	210.56	294.75	406.13	611.27	918.36

```
              1858.44     2451.42     3166.36     3972.06     4844.21     5781.98     6785.36     7854.38     8989.01

   OUTFLOW       0.00       26.73       93.57      202.72      359.23      568.38      872.87     1303.17     1873.91
              3556.07     4719.23     6128.48     7876.05     9929.15    12269.26    14900.63    17829.64    21063.76

     STAGE     822.00      823.47      824.95      826.42      827.89      829.37      830.84      832.32      833.79
               836.74      838.21      839.68      841.16      842.63      844.10      845.58      847.05      848.53

      FLOW       0.00       26.73       93.57      202.72      359.23      568.38      872.87     1303.17     1873.91
              3556.07     4719.23     6128.48     7876.05     9929.15    12269.26    14900.63    17829.64    21063.76

MAXIMUM STAGE IS     826.6

MAXIMUM STAGE IS     828.7

MAXIMUM STAGE IS     829.5

MAXIMUM STAGE IS     830.2

MAXIMUM STAGE IS     831.2

MAXIMUM STAGE IS     831.9

MAXIMUM STAGE IS     826.6

MAXIMUM STAGE IS     828.7

MAXIMUM STAGE IS     829.5

MAXIMUM STAGE IS     830.2

MAXIMUM STAGE IS     831.2

MAXIMUM STAGE IS     831.9

MAXIMUM STAGE IS     826.6

MAXIMUM STAGE IS     828.7

MAXIMUM STAGE IS     829.5

MAXIMUM STAGE IS     830.2

MAXIMUM STAGE IS     831.2

MAXIMUM STAGE IS     831.9

              **********          **********          **********          **********          **********

                                    SUB-AREA RUNOFF COMPUTATION
```

SUB AREA 2 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	C	0	C	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	18.11	0.00	152.10	0.00	C.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	85.00	97.00	102.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
1	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 7.38 R= 7.88 NTA= 0

RECESSION DATA

STRTQ= 36.00 QRCSN= 36.00 RTIOR= 1.00

UNIT HYDROGRAPH 48 END-OF-PERIOD ORDINATES, LAG= 7.10 HOURS, CP= 0.56 VOL= 1.0

45.	165.	355.	523.	7[illegible].	852.	929.	955.	859.	756.
660.	566.	515.	455.	401.	353.	311.	274.	241.	212.
187.	165.	145.	126.	112.	99.	87.	77.	68.	60.
52.	46.	41.	36.	32.	28.	24.	22.	19.	17.
15.	13.	11.	10.	9.	8.				

END-OF-PERIOD FLOW

HR.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.98	3.48	188974.
										(494.)	(406.)	(88.)	(5351.14)

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 3 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	11.63	0.00	152.10	0.00	C.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96

0.00 18.50 69.00 97.00 113.00 121.00 0.00 0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.677

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.0

UNIT HYDROGRAPH DATA

TC= 10.62 R= 10.62 NTA= 0

RECESSION DATA

STRTQ= 24.00 QRCSN= 24.00 RTIOR= 1.00

UNIT HYDROGRAPH 62 END-OF-PERIOD ORDINATES, LAG= 9.69 HOURS, CP= 0.57 VOL= 1.00

14.	52.	115.	167.	234.	303.	364.	410.	440.	452.
440.	407.	370.	337.	307.	279.	254.	231.	210.	191.
174.	159.	144.	131.	119.	109.	99.	90.	82.	75.
68.	62.	56.	51.	47.	42.	39.	35.	32.	29.
26.	24.	22.	20.	18.	17.	15.	14.	12.	11.
10.	9.	8.	8.	7.	6.	6.	5.	5.	4.
4.	4.								

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.44	15.76	3.76	118450.
										(494.)(399.)(95.)(3354.13)			

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COMBINE HYDROGRAPHS

COMBINE 3 HYDROGRAPHS AT 2

ISTAG	ICOMP	IECON	ITYPE	JFLT	JFRT	INAME	ISTAGE	ICTO
2	3	0	0	0	0	1	0	0

********** ********** ********** ***** **** **********

HYDROGRAPH ROUTING

CHANNEL ROUTE TYPE/AREA 4

ISTAG	ICOMP	IECON	ITYPE	JFLT	JFRT	INAME	ISTAGE	ICTO
3	1	0	0	0	0	1	0	0

ALL REACHES HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	ICONX	ITEMP	LSTR
0.0	0.00	0.0	1	1	0	0	0

NSTPS STOL LAG AMSKK X TSK STORA ISPRAT

1 0 0 0.000 0.000 0.000 -1. 0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELAVT	ELMAX	RLNTH	SEL
[illegible]	[illegible]	0.0800	685.0	710.0	46000.	0.00300

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

1[illegible].00	710.00	130.00	[illegible].00	150.00	690.00	475.00	685.00	525.00	685.00
850.00	690.00	900.00	710.00	925.00	710.00				

STORAGE	0.00	188.29	614.21	1277.76	2174.47	3155.98	4150.29	5157.39	6177.29
	[illegible]	9313.71	[illegible]	[illegible]	12550.13	13657.11	14768.13	15889.21	17020.35
OUTFLOW	0.00	315.21	1543.42	4110.47	8622.76	15975.29	25051.18	35713.49	47865.05
	76350.67	92591.11	[illegible]	[illegible]	148828.78	169964.66	192250.75	215465.19	240188.91
STAGE	685.0	686.3[illegible]	687.63	688.95	690.26	691.58	692.89	694.21	695.53
	697.1[illegible]	699.47	[illegible]	[illegible]	703.42	704.74	706.05	707.37	708.68
FLOW	0.00	315.21	1543.42	4110.47	8622.76	15975.29	25051.18	35713.49	47865.05
	76350.67	92591.11	[illegible]	[illegible]	148828.78	169964.66	192250.75	215465.19	240188.91

MAXIMUM STAGE IS 688.5

MAXIMUM STAGE IS 689.7

MAXIMUM STAGE IS 690.2

MAXIMUM STAGE IS 690.6

MAXIMUM STAGE IS 691.0

MAXIMUM STAGE IS 691.[illegible]

MAXIMUM STAGE IS 688.5

MAXIMUM STAGE IS 689.7

MAXIMUM STAGE IS 690.2

MAXIMUM STAGE IS 690.6

MAXIMUM STAGE IS 691.2

MAXIMUM STAGE IS 691.0

MAXIMUM STAGE IS 688.5

MAXIMUM STAGE IS 689.7

MAXIMUM STAGE IS 690.2

MAXIMUM STAGE IS 690.6

MAXIMUM STAGE IS 691.2

MAXIMUM STAGE IS 691.8

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 4 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	17.37	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 1.277

LOSS DATA

LROPT	STRKR	DLTRK	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
0	0.0	0.0	1.00	0.0	0.00	1.00	1.00	0.10	0.00	0.0

UNIT HYDROGRAPH DATA

TC= 6.73 R= 0.73 NTA= 0

RECESSION DATA

STRTQ= 54.00 QRCSN= 54.00 RTIOR= 1.00

UNIT HYDROGRAPH 51 END-OF-PERIOD ORDINATES, LAG= 7.98 HOURS, CP= 0.57 VOL= 1.00

33.	124.	250.	395.	547.	670.	768.	815.	802.	736.
650.	565.	566.	465.	415.	370.	330.	294.	262.	234.
209.	186.	166.	148.	132.	117.	105.	93.	83.	74.
66.	59.	53.	47.	42.	37.	33.	30.	26.	24.
21.	19.	17.	15.	13.	12.	11.	9.	8.	7.
7.									

END-OF-PERIOD FLOW

G PC.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	PC.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
							SUM			19.46	15.70	3.76	178062.

(494.)(399.)(95.)(5042.15)

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 5 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	0	0	0	0	0	1	C	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SMAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	C	19.65	0.00	152.10	0.00	0.000	0	1	C

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	25.00	97.00	135.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
1	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 10.10 R= 10.10 TAB= C

RECESSION DATA

STRTQ= 4.... QRCSN= 4..00 RTIOR= 1.00

UNIT HYDROGRAPH 59 END-OF-PERIOD ORDINATES, LAG= 9.22 HOURS, CP= 0.57 VOL= 1.00

28.	9c.	200.	317.	445.	571.	677.	752.	794.	798.
754.	685.	619.	560.	508.	460.	416.	377.	341.	309.
2..	254.	230.	2..	1..	171.	155.	140.	1..	115.
1..	94.	..5.	77.	7..	65.	57.	52.	47.	43.
39.	35.	32.	29.	26.	24.	21.	19.	17.	16.
14.	13.	1..	11.	1..	9.	8.	7.	6.	

C END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	200619.
										(494.)(399.)(95.)(5686.89)			

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COMBINE HYDROGRAPHS

COMBINE 3 HYDROGRAPHS AT 3

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO

	3	3	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE TO AREA 7

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IEMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QA(1)	QN(2)	QN(3)	ELMVT	ELMAX	MLNTH	SEL
0.0300	0.04	0.0200	685.0	720.0	5000.	0.0020

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV,--ETC

1500.00	720.00	1500.00	710.00	375.00	700.00	450.00	685.00	500.00	685.00
1550.00	720.00	1550.00	710.00	1550.00	720.0				

STORAGE	0.00	104.04	51.00	99.90	141.73	239.48	332.17	439.79	562.33
	573.13	1073.83	1330.77	1555.97	1797.14	2126.20	2419.15	2715.99	3016.73
OUTFLOW	0.00	311.89	1296.71	3170.43	6130.61	10382.39	16082.35	23401.45	32496.41
	41577.00	79793.09	100527.02	123961.38	150425.68	180197.00	212556.34	247408.47	284678.25
STAGE	685.00	686.04	688.08	690.12	692.37	694.21	696.05	697.89	699.74
	701.42	703.2	707.10	709.05	710.79	712.65	714.47	716.31	718.16
FLOW	0.00	311.89	1296.71	3170.43	6130.61	10382.39	16082.35	23401.45	32496.41
	41577.00	79793.09	100527.02	123961.38	150425.68	180197.00	212556.34	247408.47	284678.25

MAXIMUM STAGE IS 692.0

MAXIMUM STAGE IS 695.7

MAXIMUM STAGE IS 696.7

MAXIMUM STAGE IS 697.4

MAXIMUM STAGE IS 697.4

MAXIMUM STAGE IS 700.7

MAXIMUM STAGE IS 692.8

MAXIMUM STAGE IS 695.7

MAXIMUM STAGE IS 696.7

MAXIMUM STAGE IS 697.8

MAXIMUM STAGE IS 699.4

MAXIMUM STAGE IS 700.7

MAXIMUM STAGE IS 692.8

MAXIMUM STAGE IS 695.7

MAXIMUM STAGE IS 696.7

MAXIMUM STAGE IS 697.8

MAXIMUM STAGE IS 699.4

MAXIMUM STAGE IS 700.7

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SUB-AREA RUNOFF COMPUTATION

SUB AREA O NUMBER

IST O	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
			6		0	1	0	0

HYDROGRAPH DATA

IHYD	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	3.16	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	1.50	5.00	07.00	1 5.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.077

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.50	0.00		1.00	1.00	0.10	0.00	0.0

UNIT HYDROGRAPH DATA

TC= 6.14 R= 7.14 NTA= 0

RECESSION DATA
STRTG= 6.CC QRCSN= 6.CC RTIOR= 1.00

UNIT HYDROGRAPH 36 END-OF-PERIOD ORDINATES, LAG= 5.51 HOURS, CP= 0.57 VOL= 1.CC

14.	52.	104.	157.	195.	210.	196.	167.	142.	12C.
1C2.	87.	74.	63.	53.	45.	38.	33.	28.	24.
2C.	17.	14.	12.	10.	9.	8.	6.	5.	5.
4.	3.	3.	2.	2.	2.				

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.7C	3.76	32390.
										(494.)	(399.)	(95.)	(917.18)

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COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT 4

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
4	2	0	C	3	0	1	C	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE THRU AREA 7

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5	1	0	C	0	C	1	C	0

ALL PEAKS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
.0	1.0	1.00	1	1	3	C	C

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	C	C	0.CCC	0.CCC	C.CCC	-1.	C

NORMAL DEPTH CHANNEL ROUTING

SN(1)	SN(2)	SN(3)	ELMVT	ELMAX	RLNTH	SEL
0.0000	0.0400	0.0800	595.0	620.0	43000.	0.002CC

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

	620.00	630.00	650.00	670.00	1000.00	620.00			
STORAGE	0.00	141.84	307.60	497.28	711.02	953.33	1226.39	1530.22	1864.80
	2626.23	3053.09	3522.04	4079.89	4731.72	5477.54	6317.33	7251.10	8278.86
OUTFLOW	0.00	271.95	896.48	1833.86	3126.81	4924.60	7077.90	9590.19	12466.04
	19331.63	23334.71	27594.80	32345.09	37663.59	43579.75	50135.80	57374.62	65337.88
STAGE	595.00	596.32	597.63	598.95	600.26	601.58	602.89	604.21	605.53
	606.16	608.47	610.79	613.10	613.42	614.74	616.05	617.37	618.68
FLOW	0.00	271.95	896.48	1833.86	3126.81	4924.60	7077.90	9590.19	12466.04
	19331.63	23334.71	27594.80	32345.09	37663.59	43579.75	50135.80	57374.62	65337.88

MAXIMUM STAGE IS 603.0

MAXIMUM STAGE IS 606.6

MAXIMUM STAGE IS 608.1

MAXIMUM STAGE IS 609.4

MAXIMUM STAGE IS 611.8

MAXIMUM STAGE IS 613.1

MAXIMUM STAGE IS 603.0

MAXIMUM STAGE IS 606.6

MAXIMUM STAGE IS 608.1

MAXIMUM STAGE IS 609.4

MAXIMUM STAGE IS 611.8

MAXIMUM STAGE IS 613.7

MAXIMUM STAGE IS 603.0

MAXIMUM STAGE IS 606.6

MAXIMUM STAGE IS 608.1

MAXIMUM STAGE IS 609.4

MAXIMUM STAGE IS 611.8

MAXIMUM STAGE IS 613.7

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 7 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	17.05	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	1[illegible].50	[illegible]5.00	97.00	1[illegible]5.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
[illegible]	[illegible]	[illegible]	1.00	[illegible]	[illegible]	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 0.55 R= 0.55 TA= 0

RECESSION DATA

STRTQ= [illegible] QRCSN= [illegible] RTIOR= 1.00

UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG= 7.60 HOURS, CP= 0.57 VOL= 1.00

34.	128.	258.	407.	561.	692.	779.	819.	795.	721.
641.	570.	507.	451.	401.	357.	318.	283.	251.	224.
199.	177.	157.	140.	124.	111.	98.	88.	78.	69.
62.	55.	49.	43.	39.	34.	31.	27.	24.	21.
19.	17.	15.	13.	12.	11.	9.	8.	7.	7.

END-OF-PERIOD FLOW

AREA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	AREA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	174869.
										(494.)(399.)(95.)(4951.73)			

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 9 RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
9	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	6.00	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	85.00	97.00	105.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.0

UNIT HYDROGRAPH DATA
TC= 6.54 R= 6.54 NTA= 0

RECESSION DATA
STRTQ= 12.00 QRCSN= 12.00 RTIOR= 1.00

UNIT HYDROGRAPH 59 END-OF-PERIOD ORDINATES, LAG= 5.91 HOURS, CP= 0.57 VOL= 1.00

23.	68.	171.	262.	334.	372.	363.	321.	275.	236.
205.	174.	149.	128.	110.	94.	81.	69.	59.	51.
44.	38.	32.	28.	24.	20.	17.	15.	13.	11.
9.	8.	7.	6.	5.	4.	4.	3.	3.	

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	01564.
										(494.)(399.)(95.)(1743.3(			

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COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT 5

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICTO
5	5	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE THRU AREA 6

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICTO
6	1	0	0	0	0	1	0	0

ALL PEAKS HAVE BEEN
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	LAT	IPRP	LSTR

0.0	0.000	0.00	1	1	3	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

CH(1)	CN(2)	CN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0800	0.0400	0.0800	565.0	600.0	44750.	0.00071

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

100.00 600.00 200.00 590.00 350.00 560.00 500.00 565.00 700.00 565.00
800.00 580.00 850.00 590.00 910.00 600.00

STORAGE	0.00	407.52	873.14	1396.65	1972.66	2618.57	3316.58	4072.68	4886.88
	5760.60	7725.47	9811.06	9966.37	11189.79	12468.36	13799.21	15182.34	16617.77
OUTFLOW	0.00	560.74	1836.22	3730.04	6232.67	9355.65	13119.19	17547.56	22667.09
	37141.91	45640.11	54939.71	65044.55	75952.06	87774.97	100367.95	113772.08	127989.44
STAGE	565.00	566.64	568.64	571.53	572.37	574.21	576.05	577.89	579.74
	583.42	585.26	587.18	588.95	590.79	592.63	594.47	596.31	598.16
FLOW	0.00	560.74	1836.22	3730.04	6232.67	9355.65	13119.19	17547.56	22667.09
	37141.91	45640.11	54939.71	65044.55	75952.06	87774.97	100367.95	113772.08	127989.44

MAXIMUM STAGE IS 575.9

MAXIMUM STAGE IS 578.4

MAXIMUM STAGE IS 580.1

MAXIMUM STAGE IS 581.6

MAXIMUM STAGE IS 584.0

MAXIMUM STAGE IS 586.2

MAXIMUM STAGE IS 575.9

MAXIMUM STAGE IS 578.4

MAXIMUM STAGE IS 580.1

MAXIMUM STAGE IS 581.6

MAXIMUM STAGE IS 584.0

MAXIMUM STAGE IS 586.2

MAXIMUM STAGE IS 573.9

MAXIMUM STAGE IS >78.4

MAXIMUM STAGE IS 5a0.1

MAXIMUM STAGE IS 5c1.6

MAXIMUM STAGE IS 584.0

MAXIMUM STAGE IS >86.2

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SUB-AREA RUNOFF COMPUTATION

SUB AREA & RUNOFF

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	0	0	0		0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1		11.7c		1>c.1				1	

PRECIP DATA

SPFE	PMS	R6	R1c	R24	R4c	R7c	R96
C.C	1a.5C	c5.C	97.1	1 5.c	1cC.0	C.C	C.0

TRSPC COMPUTED BY THE PROGRAM IS c.877

LOSS DATA

LOSS	STRKR	STRTL	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIOI
		0.00	1.0	C.0C		1.0	1.7		C.CC	

UNIT HYDROGRAPH DATA

TC= 2.77 R= 2.77 TIA= 0

RECESSION DATA

STRTQ= 24.0 QRCSN= 24.0 RTIOR= 1.0

1	IT HYDR GRAPH	52 END-OF-PERIOD FLOWS,								
22.	22.	1a7.	2a3.	3?4.	455.	514.	545.	5?6.	496.	
442.	395.	356.	314.	2 C.	250.	2?3.	199.	177.	158.	
141.	126.	11c.	1?C.	8?.	8C.	71.	64.	57.	51.	
45.	40.	3?.	32.	2?.	2?.	2?.	2a.	18.	16.	
14.	13.	11.	10.	?.	c.	?.	6.	6.	5.	
5.	4.									

END-OF-PERIOD FLOW

HYDRO	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	HYDRO	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
							SUM			19.46	15.70	3.76	120C50.
										(494.)	(399.)	(95.)	(3399.43)

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SUB-AREA RUNOFF COMPUTATION

SUB AREA 1C RUNOFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10	C	0	C	0	0	1	C	0

HYDROGRAPH DATA

IHYDC	IUNIT	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	C	13.9[illegible]	C.CC	152.1C	C.CC	C.CCC	C	1	C

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
C.C[illegible]	1C.5C	65.CC	97.C[illegible]	1[illegible]5.3[illegible]	12C.CC	C.CC	C.CC

TRSPC CO MPUTED BY THE PROGRAM IS C.877

LOSS DATA

LOSS	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIOI
[illegible]	[illegible]	[illegible]	1.[illegible]	C.CC	[illegible]	1.[illegible]	1.[illegible]	C.1[illegible]	C.CC	[illegible] C

UNIT HYDROGRAPH DATA

TC= 13.1[illegible] R= 15.12 TA= C

RECESSION DATA

STRTQ= 28.[illegible] C QRCSN= [illegible]C.CC RTIOR= 1.CC

UNIT HYDROGRAPH									
1C.	37.	73.	12C.	17[illegible].	223.	27C.	329.	37C.	4C4.
4C8.	437.	455.	414.	3[illegible]4.	356.	33C.	306.	2[illegible]3.	2C3.
24[illegible].	[illegible]C5.	2[illegible]9.	194.	179.	166.	154.	143.	13[illegible].	122.
113.	1C3.	9[illegible].	8C.	4.	[illegible].	[illegible].	67.	[illegible].	57.
53.	49.	45.	42.	3[illegible].	36.	33.	31.	[illegible]9.	27.
[illegible]5.	23.	[illegible]1.	2C.	19.	17.	1C.	14.	13.	12.
1[illegible].	11.	1[illegible].	9.	[illegible].	8.	7.	7.	6.	6.
5.	5.	5.	4.	4.	4.	3.			

C END-OF-PERIOD FLOW

HYDRO	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	HYDRO	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
							SUM			19.46	15.7[illegible]	3.76	15RR62.
										(494.)	(399.)	(95.)	(3932.13)

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COMBINE HYDROGRAPHS

COMBINE 3 HYDROGRAPHS AT 6

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	3	0	0	0	0	1	C	0

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HYDROGRAPH ROUTING

CHANNEL ROUTE THRU AREA 11

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
7	1	0	0	0	0	1	C	0

ALL FLAGS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
C.0	0.000	C.CC	1	1	1	0	C

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	C.000	C.000	-1.	C

CHANNEL WITH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELMVT	ELMAX	RLNTH	SEL
0.0600	0.0400	0.0200	514.0	530.0	1400.0	0.0040

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

	0.00	20.00	60.00	120.00	210.00	313.25	412.55	537.55	677.05
	990.43	1164.20	1349.30	1545.9	1755.85	1973.19	2205.96	2446.05	2699.57
	0.00	156.9	596.00	1358.70	2517.00	4164.25	6234.05	8759.94	12813.69
	22092.00	26572.30	33052.50	42169.3	49914.41	58274.00	67279.50	76926.19	87220.77
STAGE	514.00	514.04	515.00	516.55	517.57	518.21	519.05	519.89	520.74
	506.40	505.20	504.10	524.95	525.79	526.65	527.47	528.31	529.16
FLO	0.00	156.91	596.00	1358.70	2517.00	4164.25	6234.05	8759.94	12813.69
	22092.00	26572.30	33052.50	42169.3	49914.41	58274.00	67279.50	76926.19	87220.77

MAXIMUM STAGE IS 520.4

MAXIMUM STAGE IS 522.5

MAXIMUM STAGE IS 523.4

MAXIMUM STAGE IS 524.3

MAXIMUM STAGE IS 525.7

MAXIMUM STAGE IS 527.0

MAXIMUM STAGE IS 520.4

MAXIMUM STAGE IS 522.5

MAXIMUM STAGE IS 523.4

MAXIMUM STAGE IS 524.3

MAXIMUM STAGE IS 525.7

MAXIMUM STAGE IS 527.0

MAXIMUM STAGE IS 520.4

MAXIMUM STAGE IS 522.5

MAXIMUM STAGE IS 523.4

MAXIMUM STAGE IS 524.3

MAXIMUM STAGE IS 525.7

MAXIMUM STAGE IS 527.0

********** ********** ********** ********** **********

SUB-AREA RUN-OFF COMPUTATION

SUB AREA 11 RUN-OFF

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICLTG
11	0	3	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	4.5	0.0	152.0	5.0	1.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	14.50	45.00	92.00	1 5.0	121.00	0.00	0.0

INSPC COMPUTED BY THE PROGRAM IS 0.077

LOSS DATA

LKOPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 2.76 R= 2.76 NTA= 0

RECESSION DATA

STRTG= 8.00 QRCSN= 8.00 RTIOR= 1.00

UNIT HYDROGRAPH 16 END-OF-PERIOD ORDINATES, LAG= 2.58 HOURS, CP= 0.58 VOL= 1.00

124. 404. 557. 468. 325. 225. 156. 108. 75. 52.
36. 25. 17. 12. 8. 6.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	41534.
										(494.)	(399.)	(95.)	(1176.11)

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT 7

ISTAW	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICLTO
7	2	1	0	0	0	1	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE THRU DAM NO 2 (VIC ATTERBURY)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICLTQ
7	1	1	0	0	0	1	0	0

RES ELEVS HAVE BEEN ADJUSTED

ROUTING DATA

CLOSS	CLOSS	AVG	IRES	ISAME	IPRT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTPL	LAG	AMSKK	X	TSK	STORA	ISTRAT
1		0	0.	0.00	0.000	-514.	0

CAPACITY=	0.	11.	36.	74.	140.	242.	810.	1126.
ELEVATION=	505.	510.	514.	517.	521.	526.	525.	570.

CREL	SPWID	C GW	EXPW	ELEVL	COGL	CAREA	EXPL
514.0	142.0	3.2	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	C GD	EXPD	DAMWID
515.0	2.6	1.5	1000.

DAM BREACH DATA

BR WID	Z	ELBM	TFAIL	WSEL	FAILEL
70.	1.00	505.40	1.00	514.00	516.00

BEGIN DAM FAILURE AT 44.00 HOURS

PEAK OUTFLOW IS 11181. AT TIME 52.50 HOURS

BEGIN DAM FAILURE AT 41.00 HOURS

PEAK OUTFLOW IS 25075. AT TIME 51.00 HOURS

BEGIN DAM FAILURE AT 40.00 HOURS

PEAK OUTFLOW IS 3 099. AT TIME 51.00 HOURS

BEGIN DAM FAILURE AT 39.00 HOURS

PEAK OUTFLOW IS 3 732. AT TIME 51.00 HOURS

BEGIN DAM FAILURE AT 38.00 HOURS

PEAK OUTFLOW IS 4 839. AT TIME 50.00 HOURS

BEGIN DAM FAILURE AT 39.00 HOURS

PEAK OUTFLOW IS 4 215. AT TIME 50.00 HOURS

DAM BREACH DATA

BR WID	Z	ELBM	TFAIL	WSEL	FAILEL
140.	1.00	505.40	1.00	514.00	516.00

BEGIN DAM FAILURE AT 44.00 HOURS

PEAK OUTFLOW IS 11162. AT TIME 52.00 HOURS

BEGIN DAM FAILURE AT 41.00 HOURS

PEAK OUTFLOW IS 25062. AT TIME 51.00 HOURS

BEGIN DAM FAILURE AT 40.00 HOURS

PEAK OUTFLOW IS 3 065. AT TIME 51.00 HOURS

[illegible] DAM FAILURE AT 59.00 HOURS

PEAK OUTFLOW IS 3[illegible]25. AT TIME 51.00 HOURS

[illegible] DAM FAILURE AT 50.00 HOURS

PEAK OUTFLOW IS 49[illegible]25. AT TIME 50.00 HOURS

[illegible] DAM FAILURE AT 53.00 HOURS

PEAK OUTFLOW IS [illegible]59. AT TIME 52.00 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
4[illegible].	1.[illegible]	565.4[illegible]	1.00	514.00	516.00

[illegible] DAM [illegible] AT 44.[illegible] HOURS

PEAK OUTFLOW IS 11175. AT TIME 52.00 HOURS

[illegible] DAM [illegible] AT 41.[illegible] HOURS

PEAK OUTFLOW IS [illegible]. AT TIME 51.00 HOURS

[illegible] DAM [illegible] AT [illegible] HOURS

PEAK OUTFLOW IS [illegible]2. AT TIME 51.00 HOURS

[illegible] DAM [illegible] AT 59.[illegible] HOURS

PEAK OUTFLOW IS [illegible]. AT TIME 51.[illegible] HOURS

[illegible] [illegible] AT [illegible] HRS

PEAK OUTFLOW IS [illegible]1. AT TIME 50.00 HOURS

[illegible] [illegible] AT [illegible] HRS

PEAK OUTFLOW IS [illegible] AT TIME 5[illegible] HOURS

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

[illegible] AREA IN SQUARE

ISTAQ	ICOMP	IECON	ITYPE	JRAIN	JFLT	JRGT	IHYDR	ISTAGE	ICONS
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	1	0	0

HYDROGRAPH DATA

IDHG	IHOG	IHYD	SAVE	TRSDA	TRSPC	RATIO	ISAME	LOCAL

1	[illegible]	1.03	0.00	152.10	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	85.00	97.00	105.00	120.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.877

LOSS DATA

LOSS OPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
1	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 1.13 R= 1.13 NTA= 0

RECESSION DATA

STRTQ= 2.00 QRCSN= 2.00 RTIOR= 1.00

UNIT HYDROGRAPH 7 END-OF-PERIOD ORDINATES, LAG= 1.07 HOURS, CP= 0.55 VOL= 1.00

143.	276.	119.	46.	18.	7.	3.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	19.46	15.70	3.76	10584.
										(494.)(399.)(95.)(299.71)			

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COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT [illegible]

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICTO
2	2	1	2	0	0	1	0	0

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HYDROGRAPH ROUTING

ROUTE VER DAM AT ARTWINE

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICTO
2	1	2	1	0	0	1	0	0

ALL PLANNING SPACE
ROUTING DATA

CLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.5	0.000	0.00	1	1	0		0

NSTPS	NSTAN	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-490.	-1

STAGE	490.3C	493.0C	495.0C	497.0C	5CC.0C	5C2.CC	503.5C	5C5.0C	51C.CC
FLC.	C.0C	7C0.CC	19CC.CC	3560.00	6550.00	8CCC.00	10000.CC	13:C0.00	32CC0.CC
CAPACITY=	0.	90.	175.	265.	420.	56C.	660.	76S.	1250.	247C.
ELEVATION=	490.	493.	495.	497.	5C0.	5C2.	504.	5C5.	510.	518.

CREL	SPWID	COGW	EXFW	ELEVL	COGL	CAREA	EXFL
490.3	C.0	C.C	C.C	C.0	C.C	0.0	0.0

DAM DATA

TOPEL	COGD	EXFD	DAMWID
491.1	2.0	1.5	C.

PEAK OUTFLOW IS 11134. AT TIME 52.00 HOURS

PEAK OUTFLOW IS 23591. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 3[illegible]39. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 36727. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 49763. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 62364. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 11138. AT TIME 52.00 HOURS

PEAK OUTFLOW IS 23592. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 3[illegible]47. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 3[illegible]72. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 49761. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 62631. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 11133. AT TIME 52.00 HOURS

PEAK OUTFLOW IS 23590. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 3[illegible]36. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 3[illegible]. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 4[illegible]4. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 6201. AT TIME 51.00 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 0.20	RATIO 2 0.40	RATIO 3 0.60	RATIO 4 0.80	RATIO 5 1.00	RATIO 6 1.20
HYDROGRAPH AT	1	3.02	1	301.	602.	753.	904.	1205.	1506.
	(	7.82)	(	8.53)(	17.06)(	21.32)(	25.59)(	34.12)(	42.65)(
			2	301.	602.	753.	904.	1205.	1506.
			(	8.53)(	17.06)(	21.32)(	25.59)(	34.12)(	42.65)(
			3	301.	602.	753.	904.	1205.	1506.
			(	8.53)(	17.06)(	21.32)(	25.59)(	34.12)(	42.65)(
ROUTED TO	2	3.02	1	220.	472.	599.	730.	968.	1193.
	(	7.82)	(	6.22)(	13.37)(	16.96)(	20.68)(	27.42)(	33.78)(
			2	220.	472.	599.	730.	968.	1193.
			(	6.22)(	13.37)(	16.96)(	20.68)(	27.42)(	33.78)(
			3	220.	472.	599.	730.	968.	1193.
			(	6.22)(	13.37)(	16.96)(	20.68)(	27.42)(	33.78)(
HYDROGRAPH AT	3	18.11	1	2450.	4901.	6125.	7351.	9801.	12251.
	(	46.90)	(	69.36)(	138.76)(	173.45)(	208.14)(	277.52)(	346.90)(
			2	2450.	4901.	6125.	7351.	9801.	12251.
			(	69.36)(	138.76)(	173.45)(	208.14)(	277.52)(	346.90)(
			3	2450.	4901.	6125.	7351.	9801.	12251.
			(	69.36)(	138.76)(	173.45)(	208.14)(	277.52)(	346.90)(
HYDROGRAPH AT	4	11.63	1	1230.	2460.	3076.	3691.	4921.	6151.
	(	30.12)	(	34.84)(	69.67)(	87.09)(	104.51)(	139.34)(	174.18)(
			2	1230.	2460.	3076.	3691.	4921.	6151.
			(	34.84)(	69.67)(	87.09)(	104.51)(	139.34)(	174.18)(
			3	1230.	2460.	3076.	3691.	4921.	6151.
			(	34.84)(	69.67)(	87.09)(	104.51)(	139.34)(	174.18)(
3 COMBINED	5	32.76	1	3705.	7411.	9225.	11214.	14965.	18734.
	(	84.85)	(	104.91)(	210.00)(	261.24)(	317.26)(	423.75)(	530.46)(
			2	3705.	7411.	9225.	11214.	14965.	18734.
			(	104.91)(	210.00)(	261.24)(	317.26)(	423.75)(	530.46)(
			3	3705.	7411.	9225.	11214.	14965.	18734.
			(	104.91)(	210.00)(	261.24)(	317.26)(	423.75)(	530.46)(
ROUTED TO	6	32.76	1	3153.	6622.	8331.	10345.	14049.	17759.
	(	84.85)	(	89.29)(	187.47)(	235.90)(	292.95)(	397.83)(	502.87)(
			2	3153.	6622.	8331.	10345.	14049.	17759.
			(	89.29)(	187.47)(	235.90)(	292.95)(	397.83)(	502.87)(

			3	3153.	6626.	8531.	10345.	14049.	17759.
				(89.29)	(187.47)	(235.90)	(292.95)	(397.83)	(502.87)
HYDROGRAPH AT	4	17.37	1	2170.	4340.	5424.	6509.	8679.	10849.
		(44.99)		(61.44)	(122.88)	(153.60)	(184.33)	(245.77)	(307.21)
			2	2170.	4340.	5424.	6509.	8679.	10849.
				(61.44)	(122.88)	(153.60)	(184.33)	(245.77)	(307.21)
			3	2170.	4340.	5424.	6509.	8679.	10849.
				(61.44)	(122.88)	(153.60)	(184.33)	(245.77)	(307.21)
HYDROGRAPH AT	5	19.65	1	2173.	4346.	5433.	6519.	8692.	10865.
		(50.89)		(61.53)	(123.07)	(153.83)	(184.60)	(246.13)	(307.66)
			2	2173.	4346.	5433.	6519.	8692.	10865.
				(61.53)	(123.07)	(153.83)	(184.60)	(246.13)	(307.66)
			3	2173.	4346.	5433.	6519.	8692.	10865.
				(61.53)	(123.07)	(153.83)	(184.60)	(246.13)	(307.66)
3 COMBINED	5	69.78	1	7220.	14933.	18771.	22929.	31028.	39133.
		(180.73)		(204.63)	(422.86)	(531.54)	(649.29)	(878.62)	(1108.11)
			2	7220.	14933.	18771.	22929.	31028.	39133.
				(204.63)	(422.86)	(531.54)	(649.29)	(878.62)	(1108.11)
			3	7220.	14933.	18771.	22929.	31028.	39133.
				(204.63)	(422.86)	(531.54)	(649.29)	(878.62)	(1108.11)
ROUTED T	4	69.78	1	7245.	14914.	18722.	22859.	30954.	39062.
		(177.13)		(205.16)	(422.32)	(530.14)	(646.72)	(876.52)	(1106.69)
			2	7245.	14914.	18722.	22859.	30954.	39062.
				(205.16)	(422.32)	(530.14)	(646.72)	(876.52)	(1106.69)
			3	7245.	14914.	18722.	22859.	30954.	39062.
				(205.16)	(422.32)	(530.14)	(646.72)	(876.52)	(1106.69)
HYDROGRAPH AT	4	3.16	1	523.	1045.	1306.	1566.	2090.	2613.
		(8.13)		(14.80)	(29.59)	(36.99)	(44.39)	(59.19)	(73.98)
			2	523.	1045.	1306.	1566.	2090.	2613.
				(14.80)	(29.59)	(36.99)	(44.39)	(59.19)	(73.98)
			3	523.	1045.	1306.	1566.	2090.	2613.
				(14.80)	(29.59)	(36.99)	(44.39)	(59.19)	(73.98)
2 COMBINED	4	72.94	1	7573.	15652.	19655.	23972.	32488.	41006.
		(186.91)		(214.44)	(442.65)	(556.56)	(678.60)	(919.97)	(1161.07)
			2	7573.	15652.	19655.	23972.	32488.	41006.
				(214.44)	(442.65)	(556.56)	(678.60)	(919.97)	(1161.07)
			3	7573.	15652.	19655.	23972.	32488.	41006.
				(214.44)	(442.65)	(556.56)	(678.60)	(919.97)	(1161.07)
ROUTED T	5	72.94	1	7595.	15636.	19639.	23961.	32486.	41006.
		(188.91)		(215.06)	(428.42)	(539.12)	(656.41)	(883.10)	(1107.77)
			2	7595.	15636.	19639.	23961.	32486.	41006.
				(215.06)	(428.42)	(539.12)	(656.41)	(883.10)	(1107.77)
			3	7595.	15636.	19639.	23961.	32486.	41006.
				(215.06)	(428.42)	(539.12)	(656.41)	(883.10)	(1107.77)

HYDROGRAPH AT	7	17.65	1	2166.	4333.	5416.	6499.	8666.	10832.
	(	44.16)	(	61.35)(	122.70)(	153.37)(	184.04)(	245.39)(	306.74)(
			2	2166.	4333.	5416.	6499.	8666.	10832.
			(	61.35)(	122.70)(	153.37)(	184.04)(	245.39)(	306.74)(
			3	2166.	4333.	5416.	6499.	8666.	10832.
			(	61.35)(	122.70)(	153.37)(	184.04)(	245.39)(	306.74)(
HYDROGRAPH AT	9	6.00	1	942.	1885.	2356.	2827.	3769.	4712.
	(	15.53)	(	26.68)(	53.37)(	66.71)(	80.05)(	106.73)(	133.42)(
			2	942.	1885.	2356.	2827.	3769.	4712.
			(	26.68)(	53.37)(	66.71)(	80.05)(	106.73)(	133.42)(
			3	942.	1885.	2356.	2827.	3769.	4712.
			(	26.68)(	53.37)(	66.71)(	80.05)(	106.73)(	133.42)(
3 COMBINED	5	95.99	1	9717.	20127.	25355.	30799.	41452.	51994.
	(	246.61)	(	275.14)(	569.92)(	717.98)(	872.12)(	1173.79)(	1472.29)(
			2	9717.	20127.	25355.	30799.	41452.	51994.
			(	275.14)(	569.92)(	717.98)(	872.12)(	1173.79)(	1472.29)(
			3	9717.	20127.	25355.	30799.	41452.	51994.
			(	275.14)(	569.92)(	717.98)(	872.12)(	1173.79)(	1472.29)(
ROUTED T	6	95.99	1	8878.	18869.	24015.	29337.	39888.	50256.
	(	248.61)	(	251.40)(	534.32)(	680.02)(	830.72)(	1129.51)(	1423.10)(
			2	8878.	18869.	24015.	29337.	39888.	50256.
			(	251.40)(	534.32)(	680.02)(	830.72)(	1129.51)(	1423.10)(
			3	8878.	18869.	24015.	29337.	39888.	50256.
			(	251.40)(	534.32)(	680.02)(	830.72)(	1129.51)(	1423.10)(
HYDROGRAPH AT	4	11.70	1	1456.	2912.	3640.	4368.	5824.	7281.
	(	30.30)	(	41.23)(	82.46)(	103.08)(	123.70)(	164.93)(	206.16)(
			2	1456.	2912.	3640.	4368.	5824.	7281.
			(	41.23)(	82.46)(	103.08)(	123.70)(	164.93)(	206.16)(
			3	1456.	2912.	3640.	4368.	5824.	7281.
			(	41.23)(	82.46)(	103.08)(	123.70)(	164.93)(	206.16)(
HYDROGRAPH AT	10	13.90	1	1228.	2455.	3069.	3683.	4910.	6138.
	(	36.00)	(	34.76)(	69.52)(	86.90)(	104.28)(	139.04)(	173.80)(
			2	1228.	2455.	3069.	3683.	4910.	6138.
			(	34.76)(	69.52)(	86.90)(	104.28)(	139.04)(	173.80)(
			3	1228.	2455.	3069.	3683.	4910.	6138.
			(	34.76)(	69.52)(	86.90)(	104.28)(	139.04)(	173.80)(
3 COMBINED	8	121.59	1	11117.	23511.	29644.	36562.	49630.	62424.
	(	314.41)	(	314.76)(	665.74)(	839.09)(	1035.32)(	1405.37)(	1767.53)(
			2	11117.	23511.	29644.	36562.	49630.	62424.
			(	314.76)(	665.74)(	839.09)(	1035.32)(	1405.37)(	1767.53)(
			3	11117.	23511.	29644.	36562.	49630.	62424.
			(	314.76)(	665.74)(	839.09)(	1035.32)(	1405.37)(	1767.53)(
ROUTED T	7	121.59	1	11094.	23509.	29684.	36448.	49466.	62315.

		(514.51)	(514.15)(	665.69)(	846.22)(	1032.08)(	1400.72)(	1764.56)(
			2 11694.	23509.	29884.	36448.	49466.	62315.
			(514.15)(	665.69)(	846.22)(	1032.08)(	1400.72)(	1764.56)(
			3 11694.	23509.	29884.	36448.	49466.	62315.
			(514.15)(	665.69)(	846.22)(	1032.08)(	1400.72)(	1764.56)(
HYDROGRAPH AT	11	4.05	1 1120.	2241.	2801.	3361.	4482.	5602.
		(10.49)	(31.73)(	63.45)(	79.32)(	95.18)(	126.91)(	158.63)(
			2 1120.	2241.	2801.	3361.	4482.	5602.
			(31.73)(	63.45)(	79.32)(	95.18)(	126.91)(	158.63)(
			3 1120.	2241.	2801.	3361.	4482.	5602.
			(31.73)(	63.45)(	79.32)(	95.18)(	126.91)(	158.63)(
2 COMBINED	7	125.64	1 11147.	23661.	30075.	36676.	49501.	62859.
		(325.40)	(315.65)(	670.01)(	851.62)(	1038.56)(	1413.04)(	1779.96)(
			2 11147.	23661.	30075.	36676.	49501.	62859.
			(315.65)(	670.01)(	851.62)(	1038.56)(	1413.04)(	1779.96)(
			3 11147.	23661.	30075.	36676.	49501.	62859.
			(315.65)(	670.01)(	851.62)(	1038.56)(	1413.04)(	1779.96)(
ROUTED TO	7	125.64	1 11181.	23675.	30099.	36732.	49539.	62835.
		(325.40)	(316.62)(	670.40)(	852.32)(	1040.12)(	1411.28)(	1778.41)(
			2 11162.	23666.	30065.	36725.	49525.	62809.
			(316.08)(	670.14)(	851.36)(	1039.95)(	1411.09)(	1778.36)(
			3 11175.	23650.	30062.	36682.	49516.	62865.
			(316.45)(	669.70)(	852.39)(	1038.72)(	1415.53)(	1780.71)(
HYDROGRAPH AT	12	1.03	1 423.	845.	1057.	1268.	1691.	2113.
		(2.67)	(11.97)(	23.94)(	29.92)(	35.91)(	47.88)(	59.85)(
			2 423.	845.	1057.	1268.	1691.	2113.
			(11.97)(	23.94)(	29.92)(	35.91)(	47.88)(	59.85)(
			3 423.	845.	1057.	1268.	1691.	2113.
			(11.97)(	23.94)(	29.92)(	35.91)(	47.88)(	59.85)(
2 COMBINED	7	126.67	1 11162.	23677.	30101.	36754.	49545.	62922.
		(328.07)	(316.64)(	670.44)(	852.38)(	1040.19)(	1411.46)(	1778.55)(
			2 11163.	23664.	30067.	36726.	49531.	62817.
			(316.09)(	670.09)(	851.42)(	1040.02)(	1411.06)(	1778.21)(
			3 11176.	23652.	30064.	36686.	49496.	62895.
			(316.46)(	669.75)(	852.45)(	1038.79)(	1415.50)(	1780.55)(
ROUTED TO	7	126.67	1 11134.	23591.	30039.	36727.	49523.	62814.
		(328.07)	(315.27)(	668.01)(	850.61)(	1039.98)(	1409.69)(	1777.74)(
			2 11138.	23592.	30047.	36728.	49521.	62861.
			(315.40)(	668.05)(	850.83)(	1040.01)(	1409.65)(	1777.85)(
			3 11133.	23595.	30036.	36736.	49504.	62816.
			(315.25)(	668.16)(	850.51)(	1040.24)(	1410.29)(	1778.11)(

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	220.	826.6	55.00
0.40	472.	828.7	54.00
0.50	599.	829.5	53.00
0.60	730.	830.2	53.00
0.80	968.	831.2	53.00
1.00	1193.	831.9	54.00

PLAN 2 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	220.	826.6	55.00
0.40	472.	828.7	54.00
0.50	599.	829.5	53.00
0.60	730.	830.2	53.00
0.80	968.	831.2	53.00
1.00	1193.	831.9	54.00

PLAN 3 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	220.	826.6	55.00
0.40	472.	828.7	54.00
0.50	599.	829.5	53.00
0.60	730.	830.2	53.00
0.80	968.	831.2	53.00
1.00	1193.	831.9	54.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	3153.	688.5	50.00
0.40	6628.	689.7	50.00
0.50	8351.	690.2	50.00
0.60	10145.	690.6	49.00
0.80	14249.	691.2	49.00
1.00	17759.	691.8	49.00

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	3153.	688.5	50.00

0.40	6620.	689.7	50.00
0.50	8331.	690.2	50.00
0.60	10345.	690.6	49.00
0.80	14649.	691.2	49.00
1.00	17759.	691.8	49.00

PLAN 3 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	3153.	688.5	50.00
0.40	6620.	689.7	50.00
0.50	8331.	690.2	50.00
0.60	10345.	690.6	49.00
0.80	14649.	691.2	49.00
1.00	17759.	691.8	49.00

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7245.	692.6	49.00
0.40	14914.	695.7	49.00
0.50	18722.	696.7	49.00
0.60	22739.	697.8	49.00
0.80	30954.	699.4	48.00
1.00	39682.	700.7	48.00

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7245.	692.6	49.00
0.40	14914.	695.7	49.00
0.50	18722.	696.7	49.00
0.60	22739.	697.8	49.00
0.80	30954.	699.4	48.00
1.00	39682.	700.7	48.00

PLAN 3 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7245.	692.6	49.00
0.40	14914.	695.7	49.00
0.50	18722.	696.7	49.00
0.60	22739.	697.8	49.00
0.80	30954.	699.4	48.00
1.00	39682.	700.7	48.00

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7695.	603.0	50.00
0.40	15130.	606.6	50.00
0.50	19039.	608.1	50.00
0.60	23181.	609.4	50.00
0.80	31186.	611.8	50.00
1.00	39106.	613.7	50.00

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7695.	603.0	50.00
0.40	15130.	606.6	50.00
0.50	19039.	608.1	50.00
0.60	23181.	609.4	50.00
0.80	31186.	611.8	50.00
1.00	39106.	613.7	50.00

PLAN 3 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7695.	603.0	50.00
0.40	15130.	606.6	50.00
0.50	19039.	608.1	50.00
0.60	23181.	609.4	50.00
0.80	31186.	611.8	50.00
1.00	39106.	613.7	50.00

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	7695.	573.9	52.00
0.40	15130.	578.4	51.00
0.50	19039.	580.1	51.00
0.60	23181.	581.6	51.00
0.80	31186.	584.5	50.00
1.00	39106.	586.8	50.00

PLAN 2 STATION A

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS

0.20	8878.	573.9	52.00
0.40	16879.	578.4	51.00
0.50	24015.	580.1	51.00
0.60	29337.	581.6	51.00
0.80	39688.	584.0	50.00
1.00	50656.	586.2	50.00

PLAN 3 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	8878.	573.9	52.00
0.40	16879.	578.4	51.00
0.50	24015.	580.1	51.00
0.60	29337.	581.6	51.00
0.80	39688.	584.0	50.00
1.00	50656.	586.2	50.00

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	11694.	520.4	52.00
0.40	23589.	526.5	51.00
0.50	29744.	528.4	51.00
0.60	35444.	529.8	51.00
0.80	49466.	533.7	50.00
1.00	62515.	537.0	50.00

PLAN 2 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	11694.	520.4	52.00
0.40	23589.	526.5	51.00
0.50	29744.	528.4	51.00
0.60	35444.	529.8	51.00
0.80	49466.	533.7	50.00
1.00	62515.	537.0	50.00

PLAN 3 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	11694.	520.4	52.00
0.40	23589.	526.5	51.00
0.50	29744.	528.4	51.00
0.60	35444.	529.8	51.00
0.80	49466.	533.7	50.00
1.00	62515.	537.0	50.00

1.00 62515. 527.0 50.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	514.00	514.00	515.00
STORAGE	36.	36.	53.
OUTFLOW	0.	0.	454.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.40	516.06	1.06	75.	11161.	29.42	52.00	44.00
0.46	517.49	2.49	122.	23675.	44.24	51.00	41.00
0.50	518.16	3.16	149.	30099.	49.26	51.00	40.00
0.60	51[illegible]	3.[illegible]	186.	36732.	51.86	51.00	39.00
0.85	519.97	4.97	246.	49639.	54.86	50.00	38.00
1.00	521.00	[illegible]	315.	62815.	53.70	50.00	33.00

PLA 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	514.00	514.00	515.00
STORAGE	36.	36.	53.
OUTFLOW	0.	0.	454.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
[illegible]	516.[illegible]	1.[illegible]	[illegible]	11162.	10.54	52.00	44.00
0.46	516.51	1.51	87.	23662.	34.60	51.00	41.00
[illegible]	517.[illegible]	2.[illegible]	115.	30065.	39.58	51.00	40.00
[illegible]	517.[illegible]	2.[illegible]	154.	36725.	42.54	51.00	39.00
[illegible]	519.[illegible]	4.[illegible]	196.	49625.	46.54	50.00	38.00
1.[illegible]	52[illegible].4	5.[illegible]4	245.	62[illegible]9.	44.40	50.00	33.00

PLA 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	514.00	514.00	515.00
STORAGE	36.	36.	53.
OUTFLOW	0.	0.	454.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	516.34	1.34	92.	11175.	36.[illegible]	52.00	44.00
.46	517.[illegible]	2.[illegible]	1[illegible].	23[illegible].	5[illegible].	51.00	41.00
0.50	518.01	3.01	171.	30102.	50.00	51.00	40.00
0.60	519.25	4.25	2[illegible]4.	36[illegible]2.	50.00	51.00	39.00
.85	52[illegible].41	5.41	2[illegible].	49[illegible].	61.[illegible]	50.00	38.00
1.00	52[illegible].45	[illegible].45	34[illegible].	62[illegible]5.	41.[illegible]	51.[illegible]	33.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	490.30	490.30	491.10
STORAGE	0.	0.	27.
OUTFLOW	0.	0.	207.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	504.00	12.90	699.	11134.	68.00	52.00	0.00
0.40	507.18	16.88	1035.	23591.	73.00	51.00	0.00
0.50	509.40	19.10	1199.	30039.	74.00	51.00	0.00
0.60	510.99	19.69	1411.	36727.	74.00	51.00	0.00
0.80	513.74	22.64	1821.	49783.	75.00	51.00	0.00
1.00	516.44	25.34	2231.	62804.	88.00	51.00	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	490.30	490.30	491.10
STORAGE	0.	0.	27.
OUTFLOW	0.	0.	207.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	504.00	12.90	699.	11134.	68.00	52.00	0.00
0.40	507.18	16.88	1035.	23592.	73.00	51.00	0.00
0.50	509.40	19.10	1199.	30047.	74.00	51.00	0.00
0.60	510.99	19.69	1411.	36728.	74.00	51.00	0.00
0.80	513.74	22.64	1821.	49781.	75.00	51.00	0.00
1.00	516.44	25.34	2231.	62831.	88.00	51.00	0.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	490.30	490.30	491.10
STORAGE	0.	0.	27.
OUTFLOW	0.	0.	207.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	504.00	12.90	699.	11133.	68.00	52.00	0.00
0.40	507.18	16.88	1035.	23596.	73.00	51.00	0.00
0.50	509.40	19.10	1199.	30036.	74.00	51.00	0.00
0.60	510.99	19.69	1411.	36736.	74.00	51.00	0.00
0.80	513.74	22.64	1821.	49784.	75.00	51.00	0.00
1.00	516.44	25.34	2231.	62816.	88.00	51.00	0.00

APPENDIX D

STRUCTURAL STABILITY

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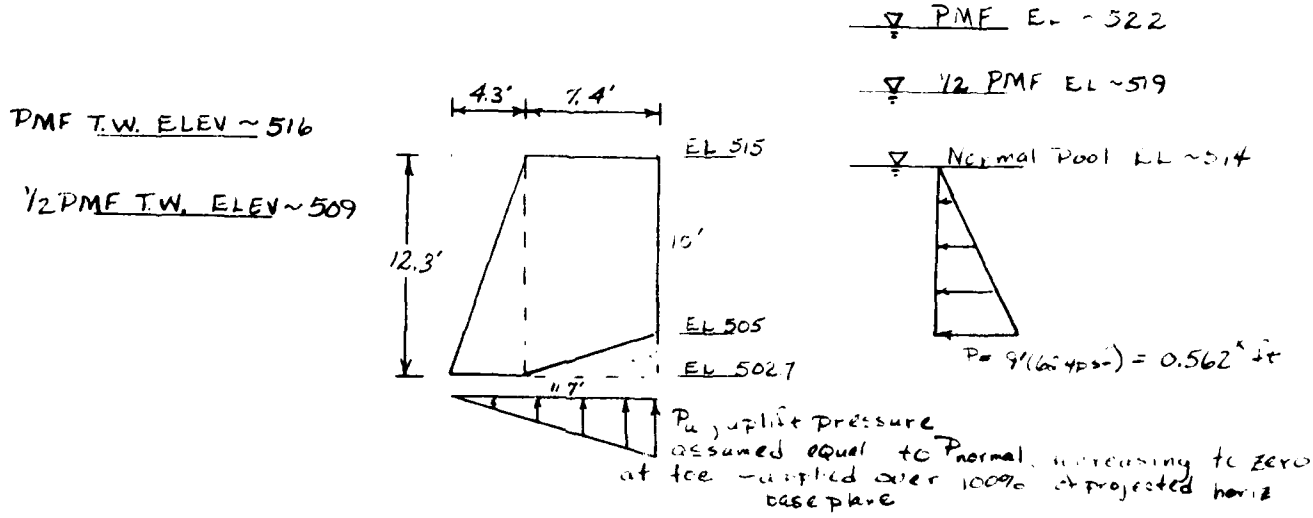
DESIGN BRIEF

PROJECT NAME _____ DATE _____

SUBJECT Antwerp Dam #2 PROJECT NO. _____

Stability Computations DRAWN BY _____

Assumed Section



Resisting Moment, due to weight of dam (about toe)

$M_R = 0.15\ kcf\left[(7.4')(12.3')(8') - (7.4')(\tfrac{1}{2})(2.3')(9.23') + (12.3')(+3\tfrac{1}{2})(\tfrac{2}{3}*4.3')\right]1'$

$M_R = 108.8^{tk}$

I. Normal Operating Conditions

A. Overturning

Moment due to upstream H_2O

$= \tfrac{1}{2}(9')(.562^{k}/ft)(2.3' + 3') = 13.4^{tk}$

Moment due to uplift

$= \tfrac{1}{2}(11.7')(.562\ ksf)(\tfrac{2}{3}*11.7')(1') = 25.64^{tk}$

Moment due to ice 5^{k} @ EL 514, 1' thick

$= 5^{k}(11.3') = 56.5^{tk}$

$F.S. = \dfrac{108.8}{13.4 + 25.64 + 56.5} = 1.14$ (uplift, ice)

$F.S. = \dfrac{108.8}{39} = 2.8$ (uplift, no ice)

F.S. = 1.56 ice, no uplift

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DESIGN BRIEF

PROJECT NAME _____ DATE _____

SUBJECT _____ PROJECT NO. _____

_____ DRAWN BY _____

B. Sliding

Weight of Dam $= 0.15\ kcf(1')\left[\frac{1}{2}(12.3')(4.3') + (7.4')(12.3') - \frac{1}{2}(2.3')(2.4')\right]$

$= 16.3^k$

Upstream H_2O Pressure $= \frac{1}{2}(9')(1')(.562\ ksf) = 2.5^k$

Uplift $(1')\frac{1}{2}(11.7')(0.562\ ksf) = 3.3^k$

Ice 5^k

Friction - shear method using 50 psi bond/shear between concrete and bedrock $\mu = 0.65$ friction coefficient

$$F.S._{sliding} = \frac{\mu N + \text{bond/shear}}{\text{Horiz. } H_2O + \text{Ice}}$$

$$F.S. = \frac{0.65\left(16.3^k - 3.3^k\right) + (0.05\ ksi)(144\ in^2/ft^2)(11.7')}{2.5^k + 5^k}$$

$= 12\pm$ (including ice)

$= 37\pm$ (no ice)

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DESIGN BRIEF

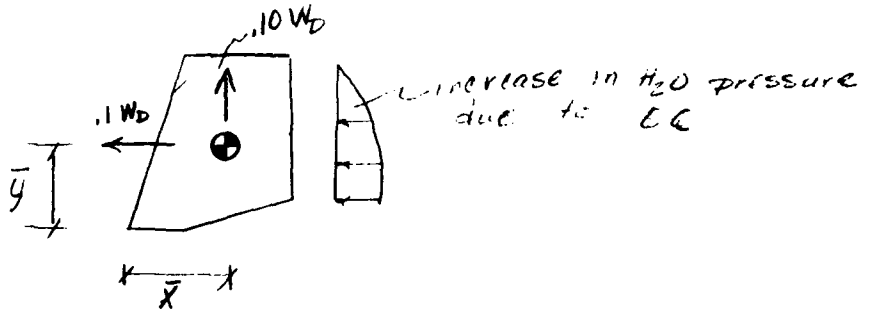
PROJECT NAME _____ DATE _____

SUBJECT _____ PROJECT NO. _____

_____ DRAWN BY _____

C. Possible Earthquake Effects

Site could be considered in Zone 3 therefore a horiz. seismic coeff = 0.10 and a conservative value of 0.10 for vert. seismic coeff. were used.



$$\bar{x} = \frac{108.8^{1-K}}{16.3^{K}} = 6.67'$$

$$\bar{y} = \frac{\left[7.4(12.3)^2/2 - \frac{1}{2}(2.3)(7.4)\left(\frac{2.3}{3}\right) + \frac{1}{2}(12.3)(4.3)\left(\frac{16.3}{3}\right)\right](.15)}{16.3^{K}} = 6.09'$$

Water surface @ normal pool

Total Horiz. increase in force V_e above any elev.

$V_e = 0.726\ P_e\ y$

P_e = increase in H_2O pressure due to EQ

y = vert. dist. from reservoir surface to elev. in Question

$P_e = C \lambda w h$

$C = .73$ for $y = 9'$ Fig. 222 Design of Small Dams.

$P_e = .73\,(0.10)(.0624^{K}/ft^3)(9') = 0.041^{K}/ft$

$V_e = 0.726(.041^{K}/ft)(9') = 0.268^{K}$

M_e = total overturning moment above that elev.

$M_e = 0.299\ P_e\ y^2 = 0.299\,(.041^{K}/ft)(9')^2 = 0.993^{1-K}$

$\therefore$ P_e is located $\frac{.993^{1-K}}{.268^{K}} = 3.71'$ above Reservoir bottom

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DESIGN BRIEF

PROJECT NAME _____ DATE _____

SUBJECT _____ PROJECT NO. _____

_____ DRAWN BY _____

∴ moment about toe due to increased H_2O pressure from EQ, M_E

$$M_E = 0.268^K (2.3' + 37') = 1.61^{1-K}$$

Max. add'l overturning moment from concrete mass due to foundation movement

$$= (0.10) 16.3^K (6.67' + 6.09') = 20.8^{1-K}$$

$$F.S. = \frac{108.8^{1-K}}{13.4 + 25.64 + 56.5 + 1.61 + 20.8} = 0.92 \quad \begin{pmatrix} EQ, Ice \& \\ uplift \end{pmatrix}$$

$$F.S. = \frac{108.8}{39 + 1.6 + 20.8} = 1.77 \quad \begin{pmatrix} EQ \& uplift \\ no\ ice \end{pmatrix}$$

D. Position of resultant from Toe, in terms of base width "b", $d = \frac{\Sigma M}{\Sigma V}$

i.) Uplift, ice

$$d = \frac{(108.8^{1-K} - 95.54^{1-K})}{(16.3^K - 3.3^K)} = 1.02' = 0.09\,b \quad \text{outside middle third}$$

ii) Uplift, no ice

$$d = \frac{(108.8 - 39)}{13} = 5.37' = 0.46\,b$$

iii) EQ, uplift no ice $d = \frac{(108.8^{1-K} - 61.4^{1-K})}{13^K - 1.63^K} = 4.17' = 0.36\,b$

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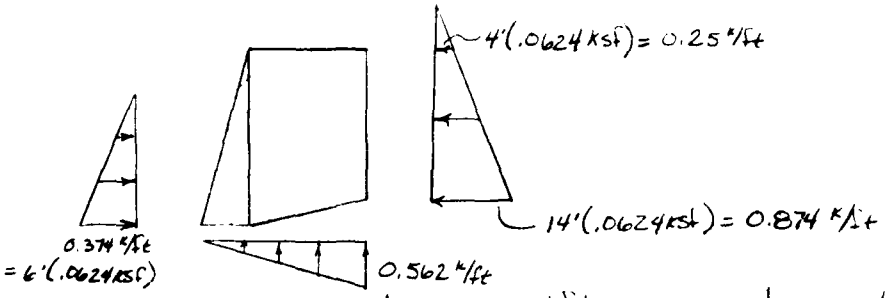
II ½ PMF



Assume uplift pressure does not have time to increase over short time frame of flood, therefore same as normal conditions.

Note: small vertical component of downstream H_2O neglected

A. Overturning

Moment due to upstream H_2O

$= 0.25^{k}/ft\,(10')(5'+2.3') + .624^{k}/ft\,(10'/2)(10'/3+2.3') = 35.8^{1-k}$

Resisting moment due to tailwater

$= 0.374^{k}/ft\,(6'/2)(6'/3) = 2.24^{1-k}$

$$F.S. = \frac{108.8 + 2.2}{35.8 + 25.6} = 1.8 \text{ (full uplift)}$$

B. Sliding

Upstream H_2O force $= (.25 + .874)\,k/ft\,(10'/2) = 5.62^{k}$

Downstream H_2O force $= 3'(.374\,k/ft) = 1.12^{k}$

$$F.S. = \frac{0.65(16.3 - 3.3) + (0.05\,ksi)(144\,in^2/ft^2)(11.7') + 1.12^{k}}{5.62^{k}} = \frac{92.7 + 1.12}{5.62} = 16.7$$

C. Position of Resultant (full uplift)

$$d = \frac{(111 - 61.4)}{13} = 3.82' = 0.33b$$

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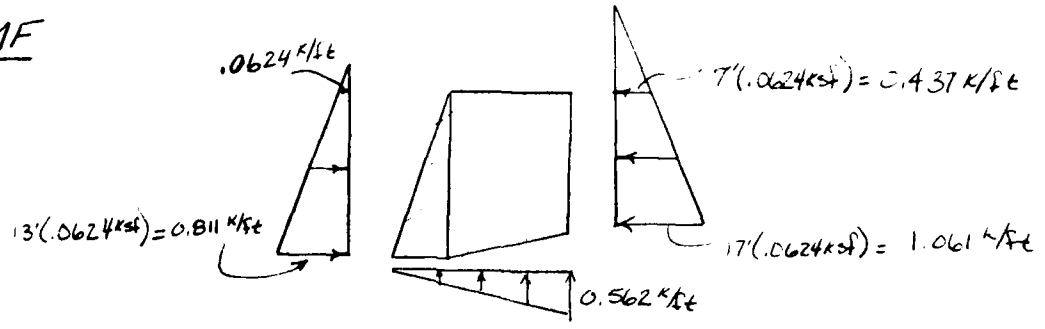
III HMF



A. Overturning

Moment due to upstream H_2O

$= (0.624\ K/ft)\left(\frac{10'}{2}\right)(3.33'+2.3') + (0.437\ K/ft)(10')(5'+2.3') = 49.5^{1-K}$

Resisting moment due to tailwater

$= (.0624\ K/ft)(12')(12'/2) + 12'(.0624\ ksf)(12'/2)(12'/3) = 22.5^{1-K}$

$F.S. = \frac{108.8 + 22.5}{49.5 + 25.6} = 1.75$ (full uplift)

B. Sliding

Upstream H_2O Force $= 10'/2\ (1.061 + .437)\ K/ft = 7.5^K$

Downstream H_2O Force $= 12'/2\ (.0624 + .811)\ K/ft = 5.25^K$

$F.S. = \frac{92.7^K + 5.25^K}{7.5^K} = 13 \pm$

C. Position of Resultant (full uplift)

$d = \frac{(131.3 - 75.1)}{13} = 4.3' = 0.37b$

APPENDIX E

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APPENDIX

REFERENCES

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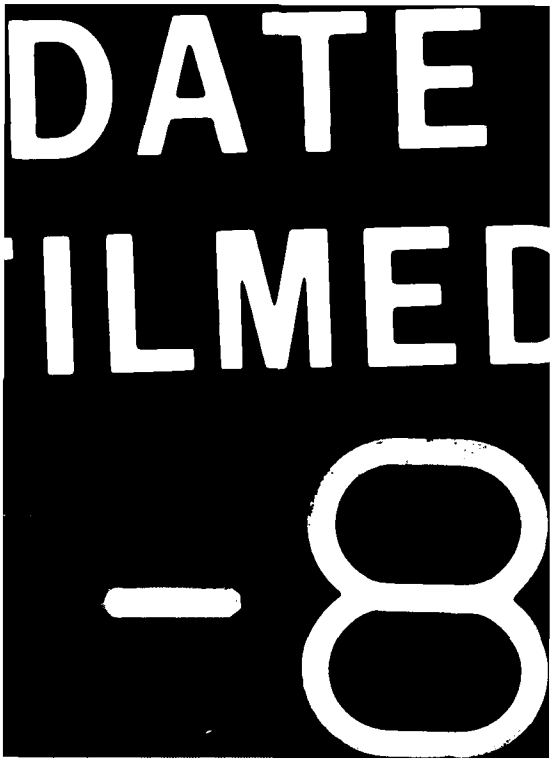
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